



Current Science

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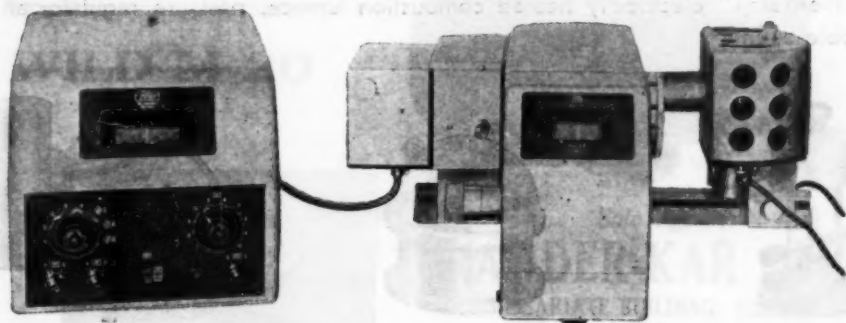
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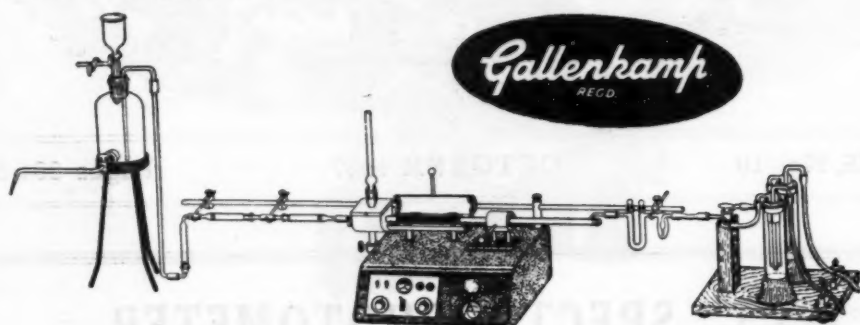
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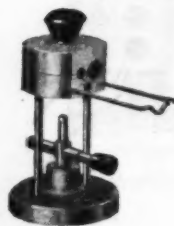
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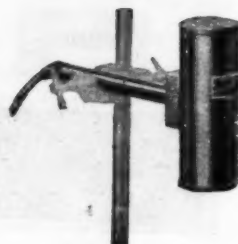
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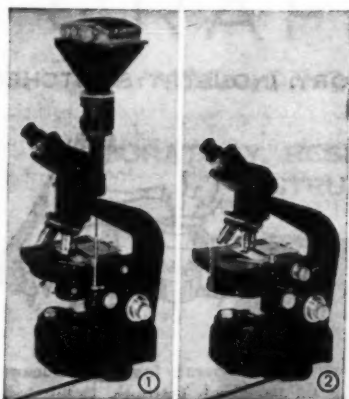
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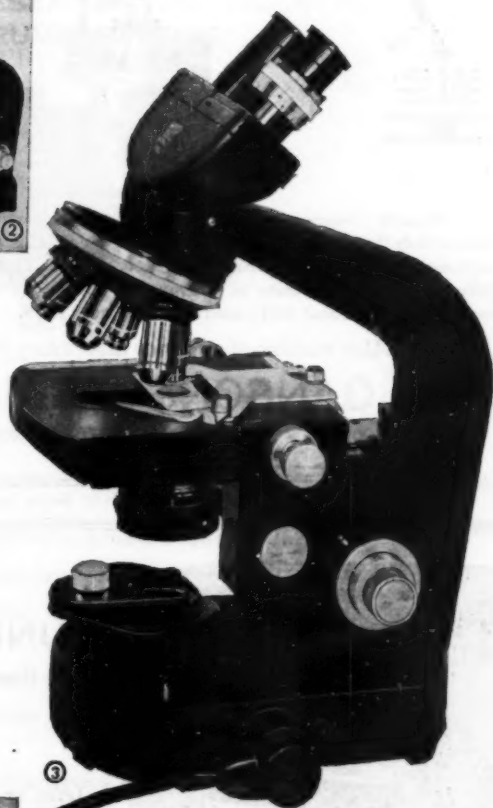


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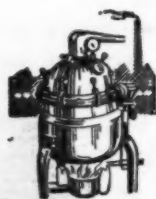
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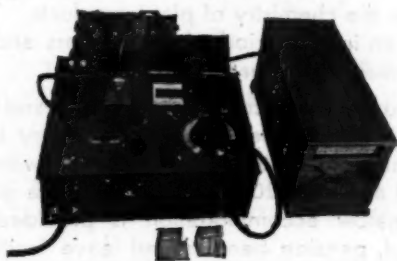
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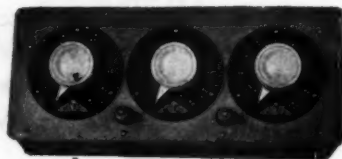
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THE CENTENARY OF LALBAGH

THE Government Botanic Gardens at Bangalore—familiarily known as Lalbagh—celebrated their Centenary this year in the month of August. The publication issued as a souvenir of the celebrations gives a very interesting history of the gardens with an account of their activities, both past and present, and also a detailed description of the garden itself. Numerous photographs exhibiting the scenic beauty of Lalbagh have been reproduced with the souvenir. Very impressive also are the photographs of trees in natural colour illustrating the souvenir, e.g., *Tecoma argentea*, *Butea frondosa* and *Cassia renigera* in all the glory of flowering time. A series of maps also appear in the souvenir which show the numbered positions on the ground, of many of the botanical treasures of the garden. These features make the publication of exceptional value and interest, alike to the layman and to the professional.

Lalbagh today with its 240 acres of tastefully laid-out grounds, its picturesque old trees,

its spreading lawns and its charming shrubberies, is a priceless asset to the rapidly growing City of Bangalore. A recent improvement for which its citizens have reason to be grateful to Dr. Mari Gowda, the present Superintendent, is the inclusion within the area of Lalbagh of the rain-fed tank which irrigates the garden and the formation of a road going round the sheet of water, as also for the removal of various unsightly features formerly present in the vicinity. It would be difficult to exaggerate the charm of the picture which meets the eye as one walks along the shady road on the tank bund, the garden itself with its many beautiful vistas on one side, and the sheet of water with the buildings of the Jayanagar Extension along the sky-line on the other side.

Lalbagh was originally a royal garden of some 40 acres in area, having been laid out in the year 1760 by Hyder Ali, and subsequently improved upon by his son Tippu. After Tippu's

fall in 1799, the garden was taken over by the British authorities. It was, however, not till the year 1856 that it became a botanic garden under State control. Amongst those who held charge of it for extended periods and who did much for its development in the past should be mentioned particularly Mr. John Cameron (1874-1908), Mr. G. H. Krumbeigel (1908-1932) and Mr. H. C. Javarayya (1932-1944). Cameron during his long term of office, did great service to the garden, his particular interest being the introduction and acclimatisation of plants of economic value to the State. A list of his introductions would be far too lengthy to be

elevation of three thousand feet above sea-level and its location half-way across the peninsula of the Deccan, has an agreeable climate with a moderate rainfall spread over 8 or 9 months in the year. As has been aptly remarked, Bangalore is India without its scorching sun and Europe without its snow. In other words, it occupies a position intermediate between the temperate and the torrid zones. It is these circumstances and the belief that it should be possible to bring the fruits of Europe to complete perfection in India by utilizing the advantages of soil and climate available at Bangalore as also the zeal, skill and perseverance of a



Lalbagh : Japanese Garden.

printed here. Mr. Krumbeigel who succeeded Cameron continued his predecessor's good work in this field and also devoted special attention in making Lalbagh the beautiful place that it is to-day.

We take the liberty of reproducing in these pages a few of the smaller pictures appearing in the souvenir volume, in order to convey some idea of the delightful scene which Lalbagh presents. But the garden is not just a park or a pleasure ground. It is a great treasure-house of plants selected from different parts of the world, acclimatised and from thence widely distributed. Bangalore, by reason of its

competent staff that encouraged the idea of making Lalbagh a botanic garden and ultimately led to its becoming an accomplished fact.

Many of the trees, fruits, vegetables and plants of economic value which are familiar to us today in India came to us *via* Lalbagh. Indeed, the success of the work of Lalbagh has in many cases been so complete that we are apt to imagine that the trees or plants are indigenous and forget the magnitude of the services rendered to the wealth, health and happiness of our people by those who laboured to bring about such satisfactory results. We are

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also liable to forget that work of this kind can never come to a stop, but should be carried on without intermission and with unabated zeal. For, India with its teeming and ever-growing population needs more than ever the services of science in the botanical field to arrest the onset of the inevitable tragedy which would result when a disproportion develops between the populations of animal and plant life in a country. Already we have with us today the

It appears here necessary also to stress the fact that though cereals form an essential part of human food, they do not constitute the whole of it. Indeed, a great variety of other plant products play, or should play a vital role in the sustenance of healthy human life. Edible seeds, nuts, fruits and vegetables should form a substantial part of any normal vegetarian diet. It is therefore a matter of the utmost importance that scientific effort is continuously devot-



Lalbagh: Trees in the *Ficus* Lawn.

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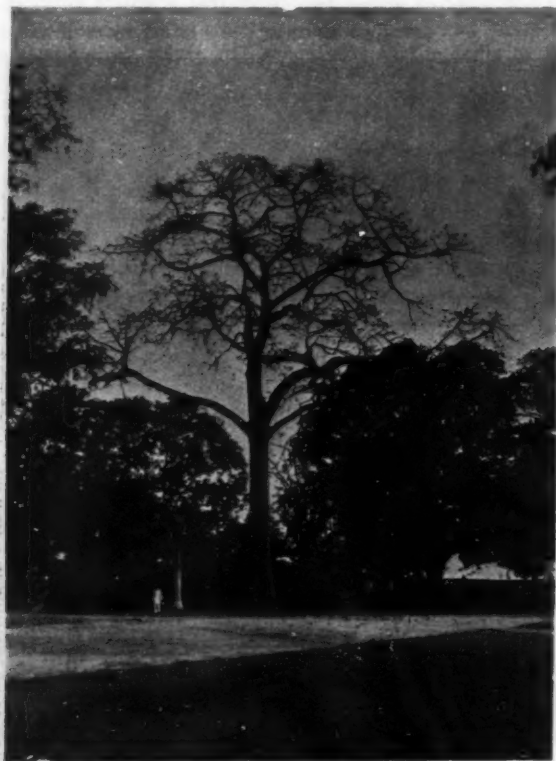
deplorable fact that the farmyard manure so essential for the production of agricultural food-stuffs is burnt as domestic fuel by reason of the lack of other combustible material. One has only to walk along our highroads or anywhere through the countryside to witness the ruthless destruction going on of trees and shrubs in the search for fuel without a thought for the future.

ed to the improvement of the quality and quantity of all such products of the plant world.

India has a flora of its own, acclimatised to the conditions set by the rainfall, nature of the soil and the rhythm of the seasons, all of which are factors varying from place to place over the area of the sub-continent. It is wisdom, of course, to make the fullest possible use of the

plant material that has established itself and proved its ability to survive and to flourish under the existing conditions. But in no circumstances should we be content to accept the position that what exists is the best or to imagine that nothing better can be found. The history of Lalbagh and of its past achievements is a reminder to us that to believe in the status

such work can only be found in the vicinity of centres of learning, such as Bangalore. *Vice versa* also, it is the association and continuous contact with such activities that can revitalize our centres of learning and serve to remind them that the aim of science is to advance knowledge of Nature and by doing so to serve the needs of humanity as well.



Lalbagh: *Bombax Malabaricum*.

quo for the plant world is a false philosophy. We must ever be prepared to accept and experiment with new material from all sources and determine what can be useful to us and take the fullest possible advantage of such material. But such work should be done by men of science, familiar alike with the latest advances of theoretical knowledge and of practical techniques. The intellectual climate necessary for

The foregoing reflections are intended to emphasise the importance of the work that Lalbagh can do in the future—as it has done in the past—if the necessary personnel and facilities are forthcoming. A full realisation of possibilities is a necessary preliminary to steps being taken towards making them actualities.

C. V. R.

* Flower
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BEAUTIFUL TREES

vicinity of the book under review* is of an unusual kind and reflects the unusual career and interests of its author. Dr. Randhawa holds the office of Vice-President of the Indian Council of Agricultural Research, the body under whose auspices the book has been printed and published. In the opening chapter of the book, he tells us how his interest in colourful flowering trees was first awakened by a stray reference in a text-book of botany and later developed in strength to an emotional fervour by the opportunities of seeing them in all their glory provided by his tours as an officer in the Indian Civil Service. It is this interest and fervour which the author seeks to convey to the readers of the book in colourful pictures and a colourful writing. Indeed, it is clearly the purpose of the book to evoke in the reader the same æsthetic and emotional response to the beauty of trees which the author feels and has sought to express in words and thereby to motivate practical action of the kind indicated by him in several of the later chapters of the book.

Dr. Randhawa's career and the book under review alike illustrate the fact that it is possible to be a hard-headed man of science wedded to the pursuit of knowledge and the attainment of practical results and yet remain keenly alive to and appreciative of all that may be described in general terms as human culture. In an official career in the administrative field he usually carries with it the extinction of all hopes of engaging in serious scientific studies or scientific research. But this was not the case with the author of the present work. Employing such modest means and facilities as he could obtain, he carried on research over a long stretch of years in the field of algology and the value of his publications in this field has been widely appreciated. It is pleasing to note that his *alma mater* has recently conferred on him the Degree of Doctor of Science in recognition of his work. In various chapters of the present book also, the man of science in Dr. Randhawa shows up clearly in the precision of statement and attention to detail which is characteristic of the language of science. But, elsewhere, he gives the rein to his artistic and literary sensibilities. The first five chapters of the book come under the latter description and would probably be the most attractive part of the book

to the general reader, while to the man of science, the sixth chapter dealing with the wandering of plants and containing suggestions for the expansion of plant-introduction and plant-breeding activities would appear to be of particular interest and importance. Indeed, it is work of the latter kind coupled with an energetic follow-up in the distribution and cultivation of the developed or introduced material which holds out the greatest possibilities of permanent benefit to the teeming millions of India.

The purpose of the book being what it is, it is easy to understand why it is accompanied by no less than 38 magnificent plates in colour depicting the trees of India in all the splendour of flowering time. It is significant that all the plates are reproductions of paintings in colour by various artists. It is possible today to reproduce the beauty of flowering trees with perfect fidelity from photographs in natural colour. It is the humanist and lover of art in Dr. Randhawa rather than the man of science who has preferred the interpretation of the beauty of trees given by the brush of the artist to the mechanical perfection which can be secured with the camera and colour film. We can safely leave the reader of the volume to judge whether the choice was the right one to make.

In the later chapters of the book, Dr. Randhawa covers many aspects of national planning connected with trees—national parks for the conservation of plant and animal life, planting trees in villages, planning home gardens and laying out avenues and parks in towns and cities. New Delhi and Chandigarh come in for special attention in the latter connection. The last five chapters contain much material of practical value to those concerned in the choice of trees and shrubs to meet various special circumstances or special needs, and instructions for planting them and for taking care of them in the early and most critical years of their growth.

The reviewer feels sure that the author of the book would consider himself amply rewarded for his labours, if the message which the book seeks to convey goes home and takes practical effect. A book so beautifully produced and illustrated and dealing with a subject of such general interest should find a place in the library of every cultured Indian home. It should be a most acceptable presentation to young men and women on all festive occasions.

C. V. R.

* *Flowering Trees in India*, by M. S. Randhawa, Published by the Indian Council of Agricultural Research, New Delhi, 1957. Pp. 210, with 38 full-page plates in colour. Price Rs. 15.

ATOMIC ENERGY IN ITALY

EVEN a casual observer cannot help being struck by the remarkable interest evinced by Italy as a nation in the development of the use of atomic energy for peaceful purposes. The June 1957 issue of the *Atom Industry* contains an illustrated supplement on the industrial nuclear programme in Italy which makes interesting reading in this direction. This is as it should be when one remembers that one of the most important pioneers in nuclear physics was Enrico Fermi. Italian interest in this field and the progress already achieved is something to be emulated particularly by Asian countries. Atomic energy has come to stay and is destined to have a considerable influence on the life of the common man in the not too distant future.

While it is true that Italians have lagged behind others in industrial application of atomic energy, it is nevertheless possible that the high level of their theoretical studies, the efficiency of their industrial concerns and the ample possibilities of the collaboration of allied countries will permit rapid progress. Bold, yet careful, programmes are being launched in order to secure new and highly important sources of energy. By 1965, it will become necessary to derive the benefits of some of the new sources such as atomic energy. It is particularly so in underdeveloped Southern Italy with its insufficient sources of water power. A spurt in this direction has been received due to the attention of concerned authorities being drawn by the Geneva Conference of August 1955. Enterprises for the construction of atomic plants have taken note of the special needs of Southern Italy where some of the earliest plants will be located. American specialists expect that within a few years the cost of atomic energy will be brought down to the level of energy produced by conventional methods. When this happens the southern regions of Italy will no longer be in an inferior condition to more fortunate areas. They will also be able to look forward to a future of economic development. In spite of lack of practical experience, the plunge has been taken in preference to waiting for a few years for the possibility of being able to build cheaper atomic plants than at present. Since Italy is a land where the cost of energy is high with a tendency to go higher, it is possible even without exact calculations to forecast that the cost of atomic energy production will be competitive with that of conventional energy. The Suez crisis has demonstrated the danger of insufficiency of energy sources and has accele-

rated the pace of development of atomic programmes.

Geological prospecting for Uranium has been progressing soon after the Second World War yielding very satisfactory results. As a result the most important find is the one at Rio Freddo where about 1,500 metres of underground workings have developed. The activities so far carried out have not only led to the extraction of a certain quantity of the ore but also pointed out the existence of ore deposits of value.

From a study of the performance of power reactors in U.K., U.S.A. and elsewhere, it is concluded that it is preferable not to limit atomic plants to one type only and so it is proposed to set up both natural and enriched Uranium plants. Legislation now under way concerning atomic energy, rejects nationalisation and consequent government monopoly of atomic energy plants. Government will own atomic fuels and will permit their industrial use by concessions. There will be government participation in addition to private enterprise for atomic energy production on conditions of equality while the sale price of energy will be regulated by government.

Industrial activity in the field of atomic energy will result in the formation of "human capital" due to the training of adequate technical and professional personnel for which Universities are insufficient by themselves. It is estimated that in five years about 2,500 technicians and about 1,200 qualified graduates will be required. Three schools have been opened for this purpose and two others will be started shortly. In these, training will be of six months' duration for graduates qualified in Physics, Chemistry and Engineering. In addition to practical training in Nuclear Physics and Electronics, there will be courses of study in Nuclear Physics, Reactor Engineering, Reactor Theory, Reactor Physics, Health Physics, Metallurgy and Chemical Engineering. Acquisition of a water boiler reactor for one school and a swimming pool reactor for another are contemplated, while the use of similar reactors for a third school is being considered.

A National Committee for Nuclear Research (CNRN) has been set up which initiates, controls, co-ordinates and allocates funds for nuclear research in Italy. The CNRN has also promoted a reorganisation of the Centre of Information, Study and Experiment (CISE) where a Reactor Group has been organised for construction and installation of a reactor at Ispra. This will

planned to be of the high neutron flux heavy water moderated natural uranium type. Initial details of its design were made available in time for the Geneva Conference. Due to difficulty in getting Uranium and heavy water and due to bilateral agreement with U.S.A. for the supply of U^{235} , it was later decided to enter into an agreement with U.S.A. for the construction of the reactor. The CP-5 heavy water moderated enriched Uranium reactor was the one selected for this purpose and the work was entrusted to the American Car and Foundry of New York who specialise in this type of reactor. This firm has also had the co-operation of CISE experts in working out the design. Researchers of the Reactor Group of CISE are now in New York and Washington to work in collaboration with the firm on the project. The power of the reactor will be 5,000 kw. with a neutron flux of 10^{14} cm.⁻² sec.⁻¹ Detailed planning of the Ispra centre where it will be installed in the spring of 1958 is also under way.

The Electrical Industry has also taken a lead in studies and projects for the building of nuclear plants. The Edison group of power companies in Italy has signed an agreement with the Westinghouse Corporation of America for the purchase of a plant of 134 million watt capacity. This will be a pressurised water reactor using enriched Uranium as fuel. The possibility of increasing its output to 240 MW with a superheater fired by conventional fuel has also been contemplated. The Società Elettro-nucleare Italiana (SELNI) set up by the main

electricity companies is about to begin its activities. SELNI has already assembled a limited number of personnel, produced a draft project and begun the study of locations suitable for installing a nuclear power plant in Southern Italy. Negotiations with overseas firms for the design and operation of this plant are well under way.

In July 1956, the Fiat and Montecatani concerns entered into an agreement for the establishment of a Society for Research on Nuclear Installations (SORIN). SORIN has now reached an advanced planning stage for installing its first reactor of the swimming pool type with its connected laboratories. This is intended for industrial research and for the production of radioactive isotopes. Later, SORIN will instal a 150 MW. nuclear power plant and a second plant in addition. SORIN will also train nuclear technicians, the first group of whom are already at its disposal. A number of these are in U.S.A., U.K. and other countries completing their training and arranging purchase of plants and equipment.

Largely due to the efforts of the CNRN, a consciousness for the necessity of exploiting this new source of energy has grown in industrial circles as also in government circles with the result that Italy will not stand by, as a mere spectator during the industrial revolution of the atomic age involving every country in the world.

S. RAMA SWAMY.

ELECTRIC POWER DIRECT FROM FISSION

IN a recent number of Nucleonics, a novel type of reactor has been proposed which converts fission energy directly into electricity by causing ionised U^{235} gas to interact with a magnetic field.

The proposed reactor is cylindrical in shape and would contain the fissionable material in gaseous form. The temperature of the gas is high enough, so that part of it is ionised. Direct conversion is accomplished by driving the ionised (and therefore electrically conducting) fissionable gas to work against a magnetic field. The work done against the field appears as electrical energy in an external circuit. The dynamical motion of the plasma (hot gas) is so arranged that after each interaction with the magnetic field, the plasma configuration is reshaped by solid walls so that magneto-hydrodynamic instabilities cannot grow from cycle to cycle.

That electrical power is generated as a result of the interaction of the moving plasma

with the coil-condenser oscillation can be understood in terms of the forced oscillation of a tuned electrical circuit. In this case, the coil and condenser in parallel, form a tuned resonant tank circuit. The oscillation is forced by the interaction of the induced eddy currents in the conducting plasma with the currents in the main coil. Eddy currents are induced in the moving plasma because the plasma is a conductor moving in a magnetic field. Since the induced current in the plasma is in such a direction as to give a net retarding force on it, the electrical oscillations in the coil condenser tank circuit are 'forced' to a greater amplitude at the expense of the mechanical energy of the plasma motion. The consequent conversion of the mechanical energy to electrical energy of resonant oscillation is the basis of electrical power generation.

Several advantages have been claimed for the proposed design.

LARGE VESSELS FOR THE STORAGE AND TRANSPORT OF LIQUID HYDROGEN AND LIQUID HELIUM*

WITH the great interest that is being evinced in experimentation in Physics and Engineering at low temperatures and the consequent development of large hydrogen and helium liquefiers, the problem of the proper design of efficient metallic vessels for storage and transport of these expensive liquids has become a matter of extreme importance. The problem is not only that of making a "low loss" vessel but also one of making it of such materials that it is capable of withstanding the mechanical shocks and vibrations that are necessarily present during transport by road, rail or air. Air transport imposes a still more stringent condition that the container should be light, capable of withstanding rapid changes in acceleration.

The remarkable invention of the vacuum insulated vessel for the storage of liquefied gases by James Dewar in 1892 has till now not been surpassed or even matched by developments in the field of thermal insulation. With high vacuum insulation, heat energy flows to the inner surface of the container by three mechanisms: (a) residual gas conduction, (b) solid conduction through piping and mechanical supports, and (c) thermal radiation. At its best the vacuum is so good that the heat transfer by the residual gas is negligible.

The problem of solid conduction is intimately connected with the mechanical strength. Perhaps the two materials that are most used for the design of piping and supports are monel and stainless steel. Since stainless steel has a lower thermal conductivity at low temperatures and also has a higher mechanical strength and lower "notch sensitivity" it is usually preferred. The recently manufactured austenitic steels of the stainless variety have proved extremely satisfactory for this purpose.

In the case of large containers the inner Dewar requires a very sturdy suspension. In designing these supports, advantage is taken of the fact that it is difficult to transfer heat across two metal plates clamped together in vacuum. This is due to the small microscopic non-uniformities which reduce the effective area of contact. It is found that the apparent thermal conductivity of laminated stainless steel with proper "dusted" surfaces can be made as low as 1/200 that of the base metal. In spite of

using these devices, if the heat conduction through the supports, etc., is substantial, it is found worthwhile to use the cold vapour escaping from the stored liquid to intercept part of the heat. The use of re-entrant tubes for increasing the effective length has also been suggested.

To minimise the transfer of heat through thermal radiation the optimum configuration of the Dewar vessel should be a sphere. In practice, only in the case of small containers spherical shapes are used. For larger vessels, the theoretical configuration must be tempered by the commercial availability of variously-shaped metal heads. To avoid the excessive thermal radiation from room temperature directly falling on the inner hydrogen container, thermal shields are used. The shield is an opaque, highly reflecting surface, geometrically similar to the liquid container, suspended between the inner and outer walls with a minimum thermal contact. In smaller containers which are commercially available (Fig. 1) the shielding is

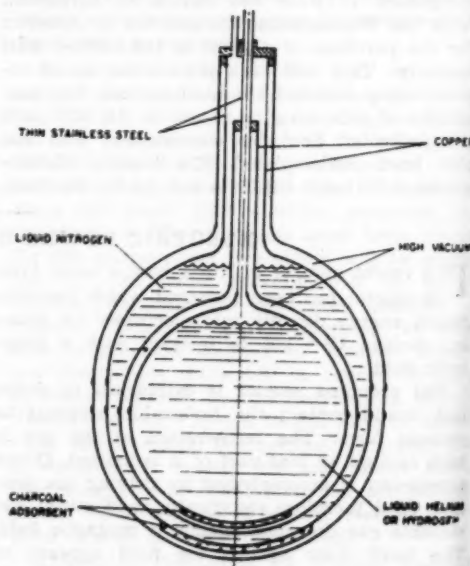


FIG. 1. Simplified cross-section of a Dewar vessel with a liquid-nitrogen-cooled shield.

effected by immersing the liquid helium container in another metal Dewar flask containing

* Based on two articles on this subject in *The Journal of Research*, National Bureau of Standards, 1957, 58, 243 and 1957, 58, 317.

liquid nitrogen (Fig. 1). In larger vessels the shield is made of a highly conducting material and is cooled at one end with liquid nitrogen and it intercepts all ambient temperature radiation from the outer shell. By this process the thermal radiation is reduced by a factor of 200 and it becomes of the order of residual gas conduction or solid conduction. The best shield materials are copper or aluminium, the latter being preferred because it maintains its high reflectivity for longer periods. A very novel method recently developed is to refrigerate the shield by the vapour boiling from the liquid.

Another method which proves comparable to the shield for providing a thermal barrier is the use of powder insulation. The method consists in filling the insulating vacuum space with fine powder such as silica aerogel, carbon black, etc. If the thickness of the insulating space is sufficient (greater than 10 cm.) filling with powder will reduce the radiant heat transfer considerably. This method also reduces the importance of minute leaks in the system. The powder insulation has been successfully used for mak-

ing large industrial containers of liquid oxygen and liquid nitrogen. At present 6,000 litres capacity liquid hydrogen storage vessels are being designed using only powder insulation!

A technical problem that arises during construction is the joining of aluminium tubes to stainless steel tubes. This is done by: (a) copper plating the aluminium tube, thus providing an excellent soft solder base, or (b) the use of ultrasonic soldering equipment which removes the troublesome oxide layer by cavitation.

The National Bureau of Standards, U.S.A., by the inclusion of many of these design features, have made liquid H_2 containers of capacities, varying from 400 to 300 litres where the daily evaporation rate is as low as 0.80%. When using these Dewar's for storage purposes, the evaporated hydrogen is reliquefied in a simple Joule Thompson type of hydrogen liquefier. With this attachment, liquid hydrogen can be stored practically indefinitely.

S. RAMASESHAN.

SEMINAR ON "MODERN DEVELOPMENTS IN PLANT PHYSIOLOGY"

ON the occasion of the visit of Professor Kenneth V. Thimann, Professor of Botany at the Harvard University, U.S.A., a Seminar on "Modern Developments in Plant Physiology" was arranged at the Department of Botany, University of Delhi, India, from August 26, 1957, to August 30, 1957.

The Seminar was inaugurated by Dr. C. D. Deshmukh, Chairman, University Grants Commission.

More than fifty research papers were read at the Seminar which was attended by several leading plant physiologists of this country and a large number of research workers. The papers were classified under various headings such as Growth and Metabolism, Photoperiodism, Vernalisation, Growth-Promoting Substances, Organ and Tissue Culture, Physiology of Pollen, General Physiology and Physiology of Fungi. Each paper was followed by a lively discussion. Several papers were read on organic acid metabolism and on the effect of ascorbic acid on growth and metabolism of plants.

In the section of "Organ and Tissue Culture", seven papers, dealing with the effect of kinetin, gibberellic acid, casein hydrolysate and other chemicals on the growth and development of anthers, ovules, ovaries and embryos *in vitro*, were presented. There were several contributions on photoperiodic and vernalisation response in plants. Papers on fungal toxins, "Fungi and Problem of Bioassay", and "Physiology of Host-Parasite Relationships in Plants" were read in the section of "Physiology of Fungi".

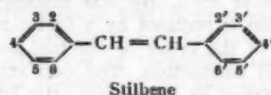
One of the highlights of the Seminar was a discussion on "Teaching and Research in Plant Physiology in India", which was initiated by Professor P. Maheshwari, Head of the Department of Botany at the University of Delhi, and Organiser of the Seminar. Several leading botanists of India took part in it including Prof. Thimann and several useful suggestions were put forward for bettering the status and teaching of plant physiology in India.

OCCURRENCE OF C₆ UNITS IN NATURALLY OCCURRING STILBENES AND PHENYL ISOCOUMARINS

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THE simplest of naturally occurring stilbenes and the earliest to be discovered was pino-sylvin.¹ This substance, its methyl ethers and dihydro-derivatives are commonly found in the heartwoods of pine trees and one or more of these are invariable components. Similarly pterostilbene is a characteristic component of the wood of *Pterocarpus* species.²⁻⁴ The occurrence of these compounds has therefore been considered to be of importance for the taxonomy of these plants. They seem to play an important part in protecting the wood from insect and fungal attack. Pterostilbene has also been found to have a curative effect on diabetes. More recently other stilbenes have been isolated mainly from the heartwood of timber-yielding plants and from certain plant drugs. The chief members occurring in Nature are given in the following table (Table I).



In naturally-occurring stilbenes the substitution of the benzene rings is of a special nature. The majority of them have no hydroxyl in an ortho-position. All of them have the 3:5-dihydroxy (methoxy) substitution in one of the rings and suggest derivation from an orcinol (or orsellinic, C₆) unit. The second part has mostly the normal substitution of the C₆ unit of eugenol derivatives, lignanes and flavonoids, i.e., 4', 3':4' and 3':4':5'. The 2':4' substitution should also be taken as normal variation, though somewhat rare (Rao and Seshadri⁵). Then the following scheme for the formation of stilbenes could be suggested involving a derived C₈ unit (Seshadri⁶) and a derived C₉ unit.

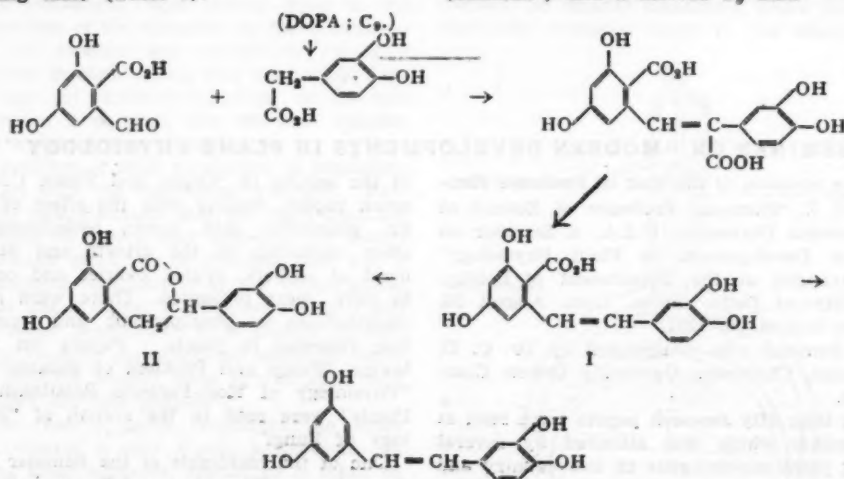


TABLE I

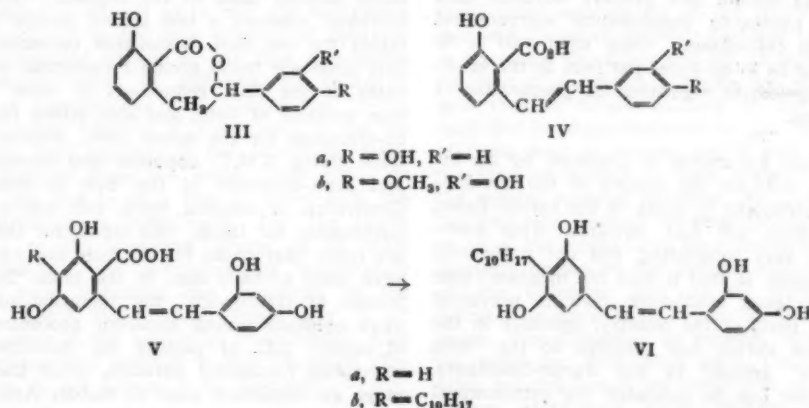
Name	Structure	Source
1 Pino-sylvin ..	3:5-dihydroxy	Heartwood of <i>Pinus sylvestris</i> , and <i>P. nigra</i>
2 Pino-sylvin monomethyl ether ..	3-hydroxy-5-methoxy	Heartwood of <i>Pinus strobus</i> , <i>P. cembra</i> and <i>P. montana</i>
3 Pino-sylvin dimethyl ether ..	3:5-dimethoxy	Heartwood of <i>P. nigra</i> and <i>P. palustris</i>
4 Resveratrol ..	3:5:4'-trihydroxy	Root of <i>Veratrum grandiflorum</i>
5 Pterostilbene ..	3:5-dimethoxy-4'-hydroxy	Heartwood of <i>Pterocarpus</i> species
6 Hydroxy resveratrol ..	3:5:2':4'-tetrahydroxy	Root of <i>Veratrum grandiflorum</i>
7 ..	3:5:3':4'-tetrahydroxy	Heartwood of <i>Vouacarpus macroptala</i> and <i>V. americana</i>
8 ..	3:5:3':4':5'-pentahydroxy	Heartwood of <i>Vouacarpus macroptala</i>
9 Rhapontigenin ..	3:5:3'-trihydroxy-4'-methoxy	Root of <i>Rheum emodi</i>
10 Chlorophorin ..	3:5:2':4'-tetrahydroxy 4-(3:7-dimethyl octa-2:6-dienyl)	Heartwood of <i>Chlorophora excelsa</i>

The above scheme seems to be supported by two observations: (i) the occurrence of stilbene-*o*-carboxylic acids and 3-phenyl dihydro-isocoumarins in nature. Two related 3-phenyl-dihydro-isocoumarins, hydrangenol (III a) and phyllodulcinol (III b) are present in varieties of *Hydrangea opuloides*. They are accompanied by the corresponding stilbene-*o*-carboxylic acids called iso-hydrangenol (IV a) and iso-phyllodulcinol (IV b). These compounds have been fully investigated by Asahina and Asano.⁷ The dihydro-isocoumarins can by treatment with alkali be readily converted into the stilbene carboxylic acids and the latter on heating close up the ring to yield the former.

It could be noticed that they have lost one of the two meta di-hydroxyl groups found in formulae (I and II). The stability of these acids

natural on the above scheme of biogenesis if the substitution (V a to V b) should take place prior to the final decarboxylation of the acid, since carbonyl derivatives of resorcinol all undergo alkylations in the 3-position which corresponds to the 4-position of stilbenes.

The question of the biogenesis of naturally occurring stilbenes has received some attention earlier. Geissman and Hinreiner⁹ attempted to adopt the C₆ + C₆ scheme as found in anthoxanthins and have focussed attention on the difficulties of the explanation. Sir Robert Robinson¹⁰ has derived the structures of pinosylvyn, pterostilbene and chlorophorin from polyketomethylenes; the scheme is quite suitable for these compounds but may not suit the other stilbenes having the 3':4'-substitution pattern of C₉ units.



could be attributed to this event which should have happened earlier by a process of reduction; the isocompounds (acids) may thus have been enabled to escape decarboxylation and undergo ring closure to yield the isocoumarins. The presence of a resorcylic acid structure would lead to ready decarboxylation, yielding the stilbenes.

(ii) The structure of chlorophorin⁸ (VI). The special feature of chlorophorin is the di-isoprenoid side chain that is found in the 4-position located between two phenolic hydroxyl groups. It would naturally be an inaccessible position if the substitution (or entry of the long chain) should be considered to take place in a pre-formed stilbene structure. But it becomes quite

1. Erdtman, *Ann.*, 1930, 539, 116; *Scientific Proceedings of the Royal Dublin Society*, 1936, 27, 131.
2. Späth and Schläger, *Ber.*, 1940, 73, 881.
3. King *et al.*, *J.C.S.*, 1953, 3693.
4. Sawhney and Seshadri, *J. Sci. Ind. Res., India*, 1956, 15 C, 154.
5. Rao and Seshadri, *Proc. Ind. Acad. Sci.*, 1943, 18 A, 234; Sawhney *et al.*, *Ibid.*, 1951, 33 A, 11.
6. Seshadri, *Ibid.*, 1944, 20 A, 1; Aghoranurthy and Seshadri, *J. Sci. Ind. Res., India*, 1954, 13 A, 114.
7. Asahina and Asano, *Ber.*, 1930, 63 B, 429.
8. King and Grundon, *J.C.S.*, 1949, 3348; 1950, 3547.
9. Geissman and Hinreiner, *Bot. Review*, 1952, 209.
10. Robinson, *The Structural Relations of Natural Products*, Clarendon Press, 1955, 9.

THE INDIAN EPHEMERIS AND NAUTICAL ALMANAC*

WE heartily welcome the publication of this first issue of the *Indian Ephemeris and Nautical Almanac* for the year 1958. The Director-General of Observatories has referred, in the Preface, to the division of labour between six countries as regards the actual calculations and computations of the figures constituting the different tables of an Ephemeris. We hope that, in course of time, it would be possible for this country to share some part of this labour instead of getting year after year advance data from other countries, and merely incorporating them in our Ephemeris. There is an urgent need to set up a first class Astronomical Observatory in the country which will undertake several types of routine observations, and also bring together a team of workers able to collate and prepare advance data from the numerous fundamental astronomical tables, and catalogues. Only then will it be possible for us to be equal partners in the international agreement regarding the preparation of basic tables.

The actual *Ephemeris* is preceded by an introductory note on the history of the development of astronomy in India in the earlier times, specially from 400 A.D. onwards. This introduction is very interesting, but not sufficiently comprehensive, in that it does not mention other contemporaneous *siddhantic* systems prevalent in several parts of the country, specially in the South. The author has referred to the "Bija corrections" applied to the *Surya-Siddhanta*, but nowhere has he indicated the astronomical significance of these corrections. The suggestion on p. xi that the value of $131' \sin g'$, given by the Indian astronomers for the equation of the centre might have been the value for $\odot - \text{J}$ does not appear convincing, since as pointed out in p. x, the inequality of the moon due to the annual equation was not used by them, and it should not be surprising if two equal errors of opposite signs cancelled each other to give the correct result. It is unfortunate, although it is a very trivial error, that the author should have used g and g' in the Introduction for the mean anomalies of the moon and sun respectively, while it is g' and g in the body of the *Ephemeris*. Without casting any reflection on the excellence of this introduction, we wish to suggest that

there is really no need to include it in all future issues of the *Ephemeris*.

Coming to the actual *Ephemeris* itself, it must be said that the several tables have been carefully chosen with an eye on essential needs, and fundamental importance. The compiler has done very well in retaining Universal Time in almost all the tables, and not converted it into Indian Standard Time. Such conversion would have meant much unnecessary labour, and really serves no useful purpose except perhaps an empty sentimental satisfaction. It would take too much space in this short review to indicate in detail how the tables of the I.A. differ from those of the A.A., and the N.A., and what exactly are the adaptations from these latter sources used in the former. We may, however, mention a few salient points. In the tables for the Sun, reasonable omissions in a first issue are those giving rectangular co-ordinates of the Sun, reductions of these to the true equinox of date, and also tables for these co-ordinates for the epoch 1950. Similarly, the table giving G.M.T., apparent and sidereal time and semi-diameter of the Sun at transit at Greenwich is omitted since this has no real significance for India. The tables for the Moon are fuller than those for the Sun, but we would have liked to have seen in the table "Moon at transit at Greenwich" the inclusion of three more columns giving apparent geocentric R.A. of centre, S.D. of passing the meridian, and equatorial horizontal parallax, since the Moon plays an important part in Indian Astronomy. In the tables for the planets, Pluto might perhaps been omitted in this first issue. In the tables for the stars, we notice that in the footnotes of the tables for mean places of 482 stars, popular names for some of the stars are given in Arabic. With a little more trouble, the corresponding names of at least the well known stars should have been given in Sanskrit also, since such information would have been useful to almanac-makers in this country. The tables relating to eclipses are very well compiled, and in this particular case, the I.S.T. might well have completely replaced U.T. without much labour. While it is no doubt a correct decision to omit all reference to occultations, some space might have been allotted to the physical Ephemerides relating to the Sun, Moon, and Planets. The miscellaneous tables of Part IV (pp. 294-324, and pp. 333-34) have been, in several cases, suitably adapted to Indian

* The *Indian Ephemeris and Nautical Almanac* for the year 1958. Published by the Manager of Publications, Delhi, 1957. Pp. xviii+392. Price Rs. 12.

conditions, and are bound to be very helpful. A table giving the angular distance of the Sun from the Moon might have been given as in the *American Ephemeris*, since the *Tithi* in Indian Almanacs is based on this elongation.

It may be pointed out that the explanations of the tables as given on pp. 379-90, are not clear and self-contained in a few cases. Nobody certainly expects any detailed explanation about the compilation of the tabular matter or about spherical astronomy, but the explanation should be clear, and make the tables unambiguous. Thus, on p. 382, bottom, correct explanation is given for the derivation of the Sun's apparent longitude for the true equinox of date, but in the case of apparent latitude referred to the true ecliptic of date, no explanation is given; in fact, the use of the correction $-0.4717 \sin(\lambda - 174^\circ)$ should have been indicated. No explanation is offered as to how the inclination of the ecliptic to the true equator of date has been calculated except to say that it includes long-period terms of nutation in obliquity. From an examination of the tables (pp. 18-21) it is not clear whether it is necessary to use the Besselian Day numbers or not, in obtaining the true obliquity from the mean value given on p. 22, and one is at a loss to know how the calculations have been made. For the tables relating to the apparent places of 68 stars (pp. 260-79), the corresponding explanation should have indicated the meanings of the entries "Sec δ , Tan δ , Dble. Trans, a , a' , b , b' " which occur at the bottom of these tables. Also the explanations relating to the Besselian Day numbers do not appear to be adequate.

The last part of the *Ephemeris* contains the Indian Calendar as part of it, in accordance with the recommendations of the Calendar Reform Committee accepted by the Government of India. This reformed Calendar is preceded by a small useful explanatory note which should be of much help to the numerous *Panchanga*-makers of our country. It is very necessary that this Calendar should be popularised early, and towards this end, the Calendar may be printed separately at a lesser cost, also translated into Sanskrit, and made available to suitable authorities in the several States who, in turn, could have them translated into the State languages, and passed on to the

almanac-makers of the regions concerned. We are a little disappointed not to find a single letter of the Sanskrit alphabet anywhere in the whole volume; at least a suitable motto might have been inserted on the front page. In showing the holidays, conventions followed in the different States have been observed as far as possible, and the total number of holidays, including those for the Moslem and Christian festivals, is only 166, and not 366 as we expected to find! In spite of the great care shown in listing the holidays, some discrepancies could, however, be found. Such a glaring one is the omission of the mention of the Lunar New Year's Day festival on 21-3-1958, which is observed all over the South and Maharashtra under the names of *Yugadi* or *Gudi Padwa*. Similarly, it appears from the Calendar that *Bali Padyami* falls on *Amavasya* day, and *Utthan Dwadasi* on *Ekadasi* day. It would have been more appropriate if the important Moslem and Christian festivals also had been shown in the main Calendar, and not in separate lists. In view of the above remarks, we wish to suggest that in future editions of the Calendar, only the holidays declared by the Government of India may be shown, and it may be left to the State to include in their adapted Calendars the several regional festivals. The names of the Zodiacal signs instead of being shown separately as on p. 390 might have been indicated by their Sanskrit names at the bottom right-hand side of the Calendar just as the names of the *Nakshatras* have been shown in the left-hand pages. The Calendar, as printed, includes data for both the *Saka* Eras, 1879 (in part), and 1880, but the names for these eras on the well-known sixty-year cycle starting *Prabhava*, *Vibhava*, etc., could also have been indicated. In fact, the names of the years of this cycle should have found a place in some part of the Calendar.

The get-up of the *Ephemeris* which is on the American model, the printing, and the arrangement of matter leave little to be desired. The strenuous work of compilation has been done very satisfactorily, and it is to be hoped that in future editions, suitable additions and amplifications will be incorporated. This first Indian *Ephemeris* is an excellent piece of work.

B. S. MADHAVA RAO.

PHARMACOLOGY OF PSYCHOTOMIMETIC AND PSYCHOTHERAPEUTIC DRUGS*

RIGHT from the dawn of history in every part of the world men have sought for the means to alter, explore and control the workings of their own mind. The intimate relationship of the mind and the body, the understanding of the self, the influence of the psyche on the abnormal behaviour of the mentally deranged individuals and attainment of the tranquilizing state of mind are facets of study which are still elusive. Until recently science has shown only sporadic interest in these matters. The reawakening in this field has come from unexpected, accidental observations of the effect of certain drugs on the mind resembling psychoses of pathological conditions and from the advent of what are known as tranquilizing agents. The rapid strides made within the short period of introduction of these psychotomimetic and psychotherapeutic drugs has led to accumulation of confusing data and had led to many unsubstantiated hypotheses.

A critical review of the existing knowledge and appreciation of the inherent difficulties involved in this unexplored field of psychopharmacology was felt an urgent necessity and forms the basis of the conference, the proceedings of which have been presented in this volume.

The first two parts discuss the clinical, biochemical and neurophysiological aspects of psychotomimetic drugs. The psychotomimetic drugs are tools capable of producing brief and controllable experimental psychoses in normal persons and thus they open new channels for the investigation of certain hypothesis concerning biochemical determination of psychoses. The effect of lysergic acid diethyl amide (LSD) on the metabolism of carbohydrates and catecholamines, the unresponsiveness of the schizophrenics to LSD both psychiatrically and in terms of autonomic responses, some abnormalities of phosphorous metabolism in clinical schizophrenics and in normal persons under the influence of LSD, considerations of epinephrine derivatives as agents in clinical psychoses and the relationship of serotonin, LSD, mescaline and reserpine to the mechanisms of psychoses discussed in the various chapters contribute new fundamental concepts on the mechanism of psychoses.

The interference of cerebral activity by LSD, mescaline, N-allylnormorphine, adrenochrome

and marihuana clearly indicate the lack of relationship between EEG and the physiological effects of the drugs. The possible electrophysiological basis of the hallucinogenic effect of psychotomimetic agents and the neurophysiological basis of emotional disturbance are still fields of speculation.

The high concentration of serotonin in the brain tissue and the antagonistic action of the hallucinogenic agent LSD on serotonin has now focussed attention on the importance of serotonin in the normal activity of the nervous system. The plausible explanation for the actions of the tranquilizing agents reserpine and chlorpromazine and the hallucinogenic agents LSD and mescaline due to the interaction with the homeostatic mechanism in the brain involving the serotonin and norepinephrine and the doubts expressed on the validity of the hypothesis by a study of 5-hydroxy tryptamine antagonists have been discussed in the third part.

The influence of conditioning factors on the psychic behaviour of the different animal species and the development of operant conditioning techniques in a wide variety of experimental problems in physiological psychology stands out as the most prominent methodological advance in psychopharmacology. An analysis of drug action on visual discrimination in domestic pigeon and the conditional avoidance responses developed in rats has confirmed the use of behavioural responses in animals as laboratory tests for the discovery of new tranquilizing agents.

The difference noticed in the metabolic behaviour of mitochondria in the brain and the liver as evidenced by the fact that chlorpromazine does not interfere with the formation of ATP by the mitochondria of the brain while it does so with that of the liver and the dissociation of EEG desynchronization and behaviour arousal under the influence of some psychotherapeutic drugs are contributions of basic significance.

It is difficult to do full justice in a short review to the entire deliberations, touching on the original work by scientists of different disciplines, on a subject still considered metaphysical in nature and presented in such an exhaustive manner. Clinicians, psychologists, pharmacologists, neurophysiologists as also biochemists will be amply rewarded by a perusal of this volume.

M. SIRSI.

* From the *Annals of the New York Academy of Sciences*, 1957, 66, Art. 3, pp. 417-840., Price \$ 5.00.

LETTERS TO THE EDITOR

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PRELIMINARY REPORT ON
THE STRUCTURE OF DIBARIUM
CUPRICFORMATE

DIBARIUM CUPRICFORMATE, $\text{CuBa}_2(\text{COOH})_6 \cdot 4\text{H}_2\text{O}$ is a crystal of paramagnetic interest. Since one of the authors (Miss K. Sundaramma) studied the paramagnetic resonance of the crystal, it was considered pertinent to determine its complete structure. The present preliminary note embodies the results of the investigations.

Groth (1910) gives the following data about this crystal which belongs to the triclinic system.

$$a : b : c = 0.5706 : 1 : 0.4438$$

$$\alpha = 92^\circ 49'; \beta = 109^\circ 3'; \gamma = 116^\circ 16\frac{1}{2}'$$

As is often the case, not all the morphological a , b , c faces could be seen on the specimens at our disposal. Hence while retaining the b and c planes as given by Groth, the plane $P_1 = (1\bar{1}0)$ is taken as our new ' a ' face in the present work.

Using CuK_α radiation and specimens of the crystal ground to cylindrical shape of diameters

of the order of 0.1 mm., the geometrical constants of the unit cell and the intensity pictures have been obtained from oscillation and Weissenberg photographs with all the three axes as rotation axes. The X-ray data thus obtained for the reciprocal unit cell we have chosen are:

$$\begin{aligned} a^* &= 0.1861 & a^* &= 83^\circ 3' \\ b^* &= 0.2174 & b^* &= 71^\circ 39' \\ c^* &= 0.2374 & \gamma^* &= 95^\circ 0' \end{aligned}$$

which gives for the real unit cell the following values:

$$\begin{aligned} a &= 8.75\text{\AA} & a &= 90^\circ 3' \\ b &= 7.16\text{\AA} & b &= 109^\circ 21' \\ c &= 6.68 & \gamma &= 82^\circ 23' \end{aligned}$$

The axial ratios for the X-ray unit cell are thus:

$$a : b : c = 1.222 : 1 : 0.9609.$$

With the above data, the transformation matrix from the Groth to the X-ray unit cell is derived as follows. The most general affine transformation of the set of axial vectors $\vec{a}, \vec{b}, \vec{c}$ to a new set $(\vec{a}', \vec{b}', \vec{c}')$ is given by

$$\begin{bmatrix} \vec{a} \\ \vec{b} \\ \vec{c} \end{bmatrix} = \begin{bmatrix} m_{11} & m_{12} & m_{13} \\ m_{21} & m_{22} & m_{23} \\ m_{31} & m_{32} & m_{33} \end{bmatrix} \begin{bmatrix} \vec{a} \\ \vec{b} \\ \vec{c} \end{bmatrix}$$

Since the b and c planes are common to both cells, \vec{a} and \vec{a}' are collinear whence $m_{12} = m_{13} = 0$. Also, since Groth $(\bar{1}10)$ is taken as the new a face, \vec{c} and \vec{c}' are collinear, making $m_{31} = m_{32} = 0$. From the above data, $\vec{a}' : \vec{a}$ comes out as 2.14, which gives 2 as the nearest integer and hence $m_{11} = 2$. Similarly $m_{33} = 2$. To determine m_{21} , m_{22} , m_{23} we see that the trace of the $(\bar{1}10)$ plane in the (a, b) plane is the \vec{b}' axis whence $m_{23} = 0$ and since the new a face is Groth's $(\bar{1}10)$, simple geometrical construction shows that \vec{b}' is of the form $(\vec{a} + \vec{b})$ and using Groth ratios and γ , the value of k comes out to be unity as the nearest integer. The matrix of transformation is thus:

$$\begin{bmatrix} 2 & 0 & 0 \\ 1 & 1 & 0 \\ 0 & 0 & 2 \end{bmatrix}$$

In the usual method of measuring α^* , β^* , γ^* from the Weissenberg pictures, there can be uncertainty of the order of 15° - $30'$ of an arc, and the variation in the cosine values at that range is about 10 to 12%. Since no attempt has been made to measure the reciprocal angles with greater precision using the more involved processes, and since the real cell constants are functions of all the three reciprocal angles, the differences of the order of 1° in Table I and the departures of the axial ratios from integers and within experimental errors. It might be mentioned, however, that the values of a , b , c would be in error only to within 2% since in the evaluation of these, the sines of the reciprocal angles are involved and also the values agree very well with rotation picture measurements which are independent of the reciprocal cell angles.

Since the indices and the axes are covariant, the same matrix transforms the Groth indices to those based on the X-ray unit cell.

Using the above data and the transformation matrix we obtain the following correspondence between the morphological and the present indices.

Morphological indices	Indices based on X-ray unit cell
(110)	(110)
(001)	(001)
($\bar{1}$.0)	(100)
($\bar{1}\bar{1}$)	($\bar{1}\bar{1}$)
(100)	(210)
(010)	(010)

For checking up, some of the interfacial angles have been calculated, using the new indices and the X-ray data and compared with the measured ones. The fair agreement as shown in Table I ensures the correctness of the identification of the planes.

TABLE I

Planes in new index system	Calculated values of the angles	Groth's values
(210 : 001)	$69^\circ 38'$	$70^\circ 57\frac{1}{2}'$
($\bar{1}\bar{1}$: 010)	$55^\circ 26'$	$54^\circ 18\frac{1}{2}'$

The volume of the unit cell is given by

$$V = abc \sin \alpha \sin \beta \sin \gamma$$

and using the X-ray data we get $V = 408 \text{ \AA}^3$. The molecular weight is 680.3 and the density as determined by the floatation method is 2.85 g./cm^3 giving one molecule per unit cell and the correct density as 2.76 g./cm^3 .

The paramagnetic interest in this crystal therefore is that it is one of the rare cupric salts containing a single type of the crystalline

field. The space group is $\bar{P}1$, as is suggested by the chemical formula and this is unequivocally confirmed by the structure analysis. The complete structure has been determined by two projections which have been refined to residual error factors of about 16%. These results will be published elsewhere in the very near future.

The authors thank Prof. R. S. Krishnan for his kind interest in the work.

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ULTRASONIC RELAXATION IN AQUEOUS SOLUTIONS OF ACETATES

ULTRASONIC propagation in a number of aqueous solutions has been studied by the authors and were reported in earlier papers.^{1,2} These include solutions of gases like sulphur dioxide, ammonia, carbon dioxide and nitrogen tetroxide and also of sulphites, bisulphites and nitrites in water. As a continuation of the same work, ultrasonic absorption, velocity and compressibility in the aqueous solutions of some inorganic acetates have been studied. Incidentally, the absorption in the binary mixtures of acetic acid in water, methyl alcohol and ethyl alcohol have also come up for study.

The experimental procedure adopted is the pulse method as reported in the earlier papers and covers a range of 2 to 26 Mc/sec. The solutions of acetates are studied from a concentration of 0.1 to 1.0 M/litre while the binary mixtures containing the acetic acid are studied from 0 to 100% by weight of the acid. All the measurements are confined to the room temperature (28°C.).

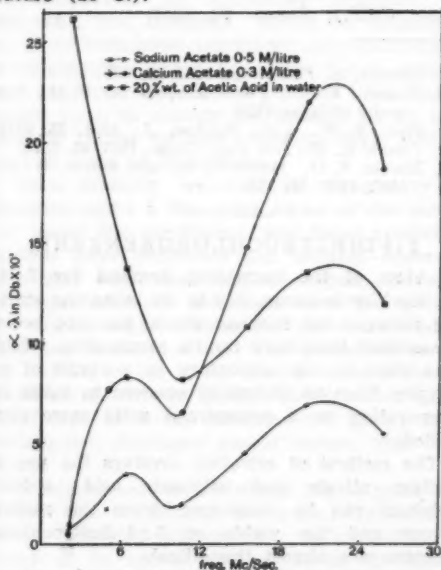


FIG. 1

The aqueous acetate solutions studied are those of lithium, sodium and potassium as well as those of calcium, strontium, barium and magnesium. The main result of the study is that all of them exhibit a double relaxation phenomenon, one below 10 Mc/sec. and the other between 10 and 26 Mc/sec. The first relaxation

frequency is found to be influenced by the cation of the acetate while the second one does not seem to be so.

Binary mixtures of acetic acid in the inert solvents are reported by Piercy and Lamb³ to exhibit a double relaxation phenomenon one below 15 Mc/sec. and the other above that frequency. It is found in the present study that binary mixtures of the acid in water, methyl and ethyl alcohols also exhibit the same phenomenon. Curves showing the variation in absorption per wavelength ($\alpha\lambda$) with frequency in the case of three representative solutions are reproduced in Fig. 1. Similar curves at various other concentrations and for the other acetate solutions have also been obtained. The similarity in the behaviour of the acetate solutions and the acetic acid-water mixtures is striking.

Details of this work are being published elsewhere. The authors thank Professor S. Bhagavantam for his keen interest and helpful guidance during the course of this work.

Physical Labs.,
Osmania University,
Hyderabad, September 17, 1957.

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STRUCTURAL CHANGES IN PARAFFIN WAX ON AGEING

THOUGH paraffin wax is known not to give electrets,¹ it was thought worthwhile to study its structure while studying the structure of the electret-giving Carnauba wax, its constituents and allied organic compounds.² Though on solidification paraffin wax is initially soft, it gradually becomes hard and brittle on ageing. X-ray diffraction patterns were taken of paraffin wax freshly solidified and also during its ageing extended over a period of some weeks.

Commercial paraffin wax (melting point 59°C.) was prepared into specimens of the usual type for X-ray diffraction studies. Powder photographs of paraffin wax indicated a long-spacing of 39.69 Å, corresponding to a predominance of the *n*-hydrocarbon $C_{20}H_{42}$.³ For transmission patterns, the molten paraffin wax was cast into thin uniform plates and a number of such plates were prepared. Some of them were selected for transmission diffraction photographs and a small circle was marked on each of them. X-ray diffraction patterns were obtained from the marked

portions only. The other plates served to check the tensile characteristics also during the corresponding ageing of the plates. Only two of the numerous photographs taken are given in the Plates 1 and 2.

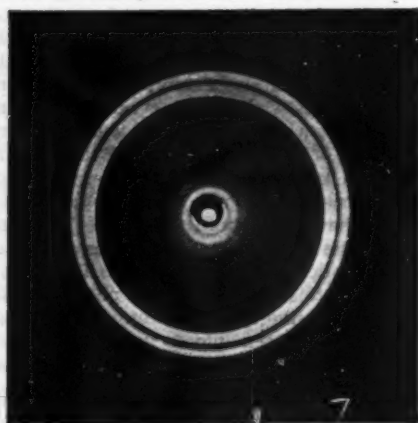


PLATE 1

Diffraction pattern of Paraffin Wax, five hours after solidification. $\text{CuK}\alpha$, 42.5 KV., 15 ma.

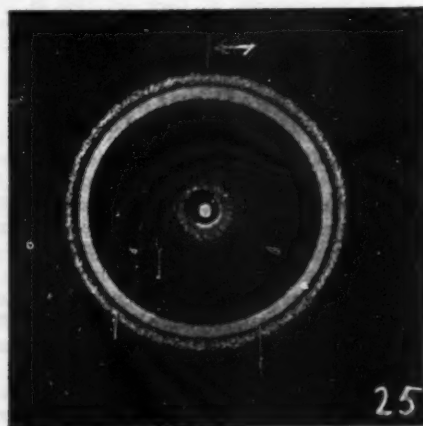


PLATE 2

Diffraction pattern of Paraffin Wax, two months after solidification. $\text{CuK}\alpha$, 42.5 KV., 15 ma.

Paraffin wax gives two prominent short spacing rings—the well-known (110) and (200) rings. When freshly solidified, all the rings are continuous. However, after about 18 days of ageing the rings begin to show spotted appearance. The spotted appearance intensifies with age. Also there is a corresponding increase in

hardness and brittleness with age of the wax, as tested on the other similar plates prepared.

The paraffin hydrocarbons crystallize in the form of plates or hollow needle-like crystals, depending upon the conditions of preparation.⁴ According to Rhodes, Mason and Sutton,⁵ the needles are nothing but rolled up plates; the plate-like crystals are the first to appear and change during ageing to hollow needle-like crystals. The plate-like crystals can slide one over the other, thus accounting for the initial higher tensile strength of the wax immediately on solidification, which enables us to pull it out like taffy. During ageing the plates tend to roll up and change to the form of hollow needles, thus becoming a mixture of plates and needles. Simultaneously the wax loses its tensile strength and becomes brittle. The diffraction patterns obtained, coupled with the observations of tensile properties of the paraffin wax, tend to support the theory of Rhodes, Mason and Sutton.

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Sagar (M.P.), August 12, 1957.

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2:4-DINITROCHLOROBENZENE

In view of the increasing demand for 2:4-dinitrochlorobenzene, due to its being the starting material for Sulphur Black, we give below a modified procedure for its preparation which was tried in our laboratory as a result of an inquiry from an industrial concern to make its preparation on a commercial scale more simplified.

The method of nitration involves the use of sodium nitrate and sulphuric acid; sodium sulphate can be recovered from the mother liquor and the yields of 2:4-dinitrochlorobenzene are almost theoretical.

To an ice-cooled mixture of 56 g. of chlorobenzene and 200 c.c. concentrated sulphuric acid in a three-necked flask, provided with a mechanical stirrer, was added 156 g. of sodium nitrate in small amounts at such a rate that the temperature of the mixture did not rise above 50°. After all the sodium nitrate was added, the temperature of the mixture was slowly raised to 95° and maintained there for 6 hours, the

stirring being continued all the time. A test portion of the reaction liquid poured over ice immediately solidified indicating that the reaction was complete.

The acid mixture was poured over ice, the yellow solid filtered, washed free from acid and dried. Yield 98 g., m.p. 51° C. The mother liquor on evaporation gave 190 g. of sodium sulphate.

Institute of Science,
Bombay-1,
September 29, 1957.

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BIDALOTITE

In the year 1937, we described¹ from certain biotite-cordierite-hypersthene granulites from Mysore, a new orthorhombic pyroxene, bidalotite; the reasons why we considered it as a pyroxene and not an amphibole, were further discussed by one of us (B. R.) in 1945.² A few years later, Rabbitt³ from his X-ray studies of the mineral, pointed out, however, that the mineral reveals an 'amphibolic' structure, and therefore that bidalotite should be considered as an orthorhombic amphibole, corresponding to anthophyllite. Apart from the X-ray studies, the one other criterion which has been chiefly relied upon to classify the mineral as an amphibole is the inclined cleavage angle noticeable in some of its sections.

Quite recently, we took an opportunity to examine again a few more slides of the mineral under the microscope, and these reinvestigations have confirmed our original observation that while the diamond-shaped cleavages of amphiboles are noticeable in a few grains, the characteristic rectangular pyroxenic cleavages are seen in many. The grains examined by Rabbitt in his X-ray studies were probably those of the former group; the question as to what type of X-ray structure the grains with rectangular cleavages would reveal, still remains.

In this connection, we would like to point out further that the mineral which we have described as bidalotite differs from anthophyllite in many of its optical characters,—in its higher indices of refraction; lower birefringence; colour, intensity, and scheme of pleochroism; and smaller optic axial angle. In view of these significant differences, it is difficult straightaway to accept that our bidalotite is the same as anthophyllite. On the other hand, as already pointed out in our 1937 paper, bidalotite resembles in many respects the hypersthene with

which it is closely associated. Nevertheless, it differs from hypersthene also in some of the optical characters,—in having lower indices of refraction and a different scheme of pleochroism.

To us, it appears that in the mineral assemblage noticed in these granulites, there is a gradational series ranging from an orthorhombic amphibole (anthophyllite) to an orthorhombic pyroxene (bidalotite). Consequently, it is necessary to make further X-ray studies of a series of these mineral grains selected from different specimens of the rock and ascertain whether all of them would show a definite 'amphibolic' structure, irrespective of variations in the cleavage angles and differences in optical characters. Till the results of such investigations are available, we would hesitate to accept that the mineral we have described as bidalotite is actually an orthorhombic amphibole, allied to anthophyllite (gedrite).

Bangalore,
September 22, 1957.

B. RAMA RAO.
L. RAMA RAO.

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INVESTIGATIONS IN NON-AQUEOUS SOLVENTS

Part IV. Solubility and Conductances of Some Metal Acetates in Ethanolamine and Ethylene Glycol

In an earlier paper,¹ the solubility and conductances of anhydrous acetates of La^{+3} , Ce^{+3} and Th^{+4} in anhydrous ethylenediamine (EN) was presented. Similar studies of these metal acetates in anhydrous monoethanolamine (MEA) and ethylene glycol (EG) are summarised in this paper.

Salt	Solubility in g. salt/100 g. solvent at 30° C.		
	MEA	EG	EN ¹
$\text{La}(\text{OAc})_3$	23.78	2.02	8.01
$\text{Ce}(\text{OAc})_3$	41.36	1.60	12.41
$\text{Th}(\text{OAc})_4$	70.81	0.41	4.30

The greater solubilities of these anhydrous metal acetates in MEA than in EN are in accord with the results obtained by Moeller and Zimmermann for neodymium and yttrium acetates.² EG appears to be a poorer solvent than EN and MEA for these salts. As would be expected from the structures of these solvents MEA does

not occupy an intermediate position as regards solubility between EN and EG. Our experiments indicate the following order of solubility of the metal acetates in the solvents— $EG < EN < MEA$. But Isbin and Kobe's comprehensive studies indicate that the solubilities of a number of salts in MEA were intermediate between that in EN and EG.³ Contrary to their observations, we find the solubilities of these three anhydrous metal acetates are lowest in EG and greatest in MEA. Even though the dielectric constants of EG and MEA are similar (37.7 at 25°C.) and higher in comparison with that of EN (12.9 at 25°C.), it is surprising to note the low solubilities of these salts in EG as compared with that in MEA. The MEA solutions of these salts are viscous and the dissolution is slightly exothermic. Cerium (III) acetate solution in MEA gradually changes from yellow to dark brown in colour as the concentration of the salt increases. Solution of the same salt in EG turns yellow on exposure to air. This is doubtless due to the atmospheric oxidation of Ce^{+3} to Ce^{+4} . Thorium (IV) acetate forms a yellow saturated solution.

Solvates with the following composition $[La(OAc)_3 \cdot 2EG]$ and $[Ce(OAc)_3 \cdot 2EG]$ have been isolated. No solvates were obtained with MEA.

Conductivity data at 30°C.

(a) MEA Solutions

La (OAc) ₃		Ce (OAc) ₃		Th (OAc) ₄	
C	Λ	C	Λ	C	Λ
0.0084	2.688	0.2102	2.950	0.1820	3.471
0.0492	3.095	0.1051	3.652	0.0960	3.896
0.0246	3.597	0.0526	4.304	0.0480	4.389
0.0123	3.964	0.0263	5.04	0.0240	5.042
0.0062	4.408	0.0132	5.591	0.0120	5.417
0.0031	4.960	0.0066	6.108	0.0060	5.667
0.0016	5.770	0.0033	6.58	0.0030	6.533
0.0008	7.725	0.0016	6.981	0.0015	7.453
..	..	0.0008	7.725	0.0008	10.150
..	..	0.0004	8.625

(b) EG Solutions

La (OAc) ₃		Ce (OAc) ₃		Th (OAc) ₄	
C	Λ	C	Λ	C	Λ
0.0528	2.076	0.0168	1.422	0.0096	0.4279
0.0274	2.356	0.0084	1.550	0.0048	0.5306
0.0132	2.545	0.0042	1.659	0.0024	0.7362
0.0066	2.720	0.0021	1.729	0.0012	1.244
0.0033	3.145	0.0010	1.795	0.0006	2.436
0.0016	3.418	0.0005	3.329	0.0003	4.310
0.0008	3.694	0.0003	5.176
0.0004	3.951

Typical conductance data, as summarised hereunder, (Equivalent conductance, Λ , mhos cm^2 equiv.⁻¹, concentration, C , of the salt in gm. equiv. per litre), indicate that both MEA and EN are reasonably good electrolytic solvents for these metal acetates while EG is not.

The equivalent conductances of these metal acetates in the solvents are in this order $MEA > EN > EG$. The greater equivalent conductances in MEA than in EN for covalent compounds like the metal acetates as observed by Moeller and Zimmermann is in accord with our values for acetates of Ce^{+3} and Th^{+4} ; but Lanthanum (III) acetate seems to be an exception to this. It is quite surprising to note that the equivalent conductances of these metal acetates are lower in EG than those in EN, notwithstanding the higher dielectric constant of the former. EG and MEA have the same dielectric constants and viscosities, the latter being slightly different (viscosities of MEA and EG respectively at 25°C. are 193.46 and 173.3 millipoises). Under these circumstances one should expect the same order of equivalent conductances, but our experiments indicate that equivalent conductances of these metal acetates in EG are lower than that in MEA. Thus the trends of solubility and conductances in non-aqueous solvents cannot be predicted easily. Details of this work will be published elsewhere.

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Presidency College,

Madras-5, September 6, 1957.

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1. Muniyappan, T. and Anjaneyalu, B., *Proc. Ind. Acad. Sci.*, 1957, **45A**, 412.

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ESTIMATION OF CERIUM BY OXIDATION WITH PERCHLORIC AND SULPHURIC ACID MIXTURE

THE volumetric estimation of trivalent cerium is confined mainly to the persulphate oxidation method.¹ This method can be applied to sulphate alone and therefore any other salt of trivalent cerium for estimation has to be converted to sulphate. The conversion to sulphate with simultaneous removal of anions like chloride, nitrate, acetate, oxalate, etc., is achieved by heating with H_2SO_4 to SO_3 fuming stage. The conversion is then followed by the operation of oxidation with persulphate. The method suggested by us not only achieves the

two objectives of conversion and oxidation in one operation but also saves time. Any salt given in the solid state or in solution has to be heated in a 750 c.c. conical flask over sand-bath with 5 c.c. of 70% HClO_4 and 10 c.c. of strong H_2SO_4 till fumes of oxides of chlorine and perchloric acid cease to come out as indicated by the beginning of the formation of heavy SO_3 fumes inside the flask. The oxidation is complete as the contents take an orange colour. After carefully diluting with water, the contents are to be cooled. The estimation is then carried out by addition of a known quantity of ferrous ammonium sulphate solution and back-titrating the unoxidised iron with standard KMnO_4 solution. The data recorded in Table I furnish the comparative values obtained by our method and by the method of persulphate oxidation. There is complete agreement between the two methods. The salts used, namely, sulphate, chloride and nitrate, were of E. Merck extra pure quality, free from other rare earths and the acetate was prepared in the laboratory from nitrate and acetic anhydride. Solutions of the salts were prepared and definite volumes were taken for estimation by the two methods. Duplicate experiments were carried out and concordant results were obtained which have been recorded in Table I.

TABLE I

Name of the salt		Perchloric oxidation g.	Persulphate oxidation g.
Nitrate	..	0.1552	0.1552
Chloride	..	0.2396	0.2398
Sulphate	..	0.2561	0.2561
Acetate	..	0.2340	0.2340

It has also been observed by us that the conversion of organic salt to sulphate is a tedious process. In the presence of perchloric acid, the process is very much simplified. Perchloric acid has to be used with caution in the case of organic salts. However, solution of the salt in water has proved to be quite safe. Heating first to SO_3 fuming stage, followed by addition of perchloric acid and again heating till SO_3 just begins to rise in the flask may be adopted.

Dept. of Chemistry,
Ravenshaw College,
Cuttack-3,
September 13, 1957.

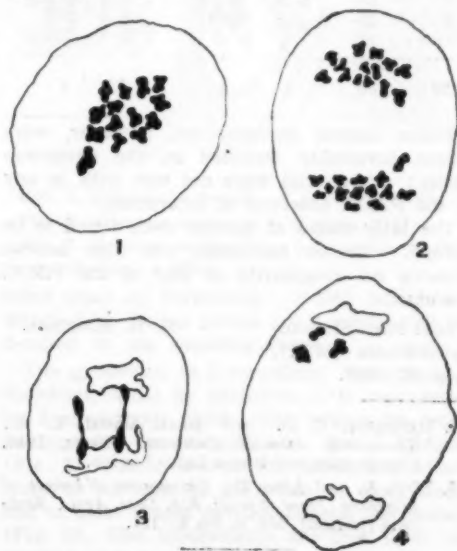
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K. SINGH.
A. CHIRANJEEBI.

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CHROMOSOMES IN AGROPYRON SCABRIFOLIUM

THE genus *Agropyron*, like *Triticum*, constitutes a polyploid series with 7 as the basic number. The importance of *Agropyron* is chiefly because of its successful hybridization with *Triticum* and because of its certain species having provided 'A' genome and the other species 'A', 'B' and 'D' (*Agropyron elongatum*) to common wheat.

Considerable advance has been made during recent years in our knowledge of the *Agropyron* chromosomes and several species belonging to this genus have been investigated in this direction. But a reference to previously published lists of chromosome numbers (of Darlington and Janaki Ammal, 1945; Löve and Löve, 1948) indicates that chromosome counts for *Agropyron scabrifolium* (Link.) Steud have not been reported so far. A brief account of the preliminary observations on the meiotic behaviour of chromosomes of this species is presented herewith. Seeds of this species were received from Uruguay.



Agropyron scabrifolium

- FIG. 1. Metaphase I (14 bivalents).
FIG. 2. Anaphase I (14 + 14).
FIG. 3. Anaphase I (2 chromatid Bridges).
FIG. 4. Late anaphase I (3 lagging univalents).

A polar view of the equatorial plate in the metaphase I clearly shows 14 bivalents. Several plates showing this stage were examined and in all of them invariably, the number of chromosomes was 14 II. Not a single univalent

was observed at metaphase I. Multivalent formation was also not noticed.

At anaphase I, normal disjunction of the bivalents was observed and the 14 chromosomes moved to each pole normally with a few exceptions. Mainly two types of irregularities were observed during the first anaphase: (i) the delayed separation of bivalents which may be due to late terminalization of chiasma. This resulted in a chromatin bridge which looked much like an inversion bridge except that an acentric fragment did not accompany it; (ii) lagging of chromosomes. Analysis of these irregularities are given in Table I.

TABLE I

Chromosome number and percentage P.M.C. in *Agropyron scabrifolium* with different irregularities

Chromosome Nos. <i>2n</i>	P.M.C. examined	Laggards at Ana. I		Delayed separation	
		% P.M.C. with laggards	Maximum laggards per cell	% P.M.C. with delayed separation	Maximum bivalents per cell
28	50	4	4	12	4

These lagging chromosomes, however, were almost invariably included in the daughter-nuclei; micronuclei were not met with in any of the P.M.C. observed at interphase.

The later stages of meiosis were found to be normal. Tetrad formation was also normal showing no irregularity in any of the P.M.C. examined.

Wheat Res. Station,
Powarkheda (M.P.),
July 16, 1957.

P. K. KAUSHAL.

1. Darlington, C. D. and Janaki Ammal, E. K., *Chromosome Atlas of Cultivated Plants*, 1945, George Allen and Unwin Ltd., London.
2. Löve, A. and Löve, D., *Chromosome Numbers of Northern Plant Species*, Rep. Dept. Agri., Reykjavik (Iceland), Ser. B, No. 3, 131.

CHROMOSOMAL TYPES IN *ADIANTUM CAUDATUM* L.

THE genus *Adiantum*, belonging to the family *Adiantaceae*, has a very wide distribution in warmer parts of the world. This genus has got some 200 recognized species, out of which 12 species have been reported from India, growing either in a wild state or in cultivated form in ferneries.¹

In the present communication, cytological observation of *A. caudatum* collected locally is presented. For meiotic studies Ferric Chloride Acetocarmine squash was done and for mitotic plates, pretreatment in 8-hydroxyquinoline followed by acetic orcein squash was adopted and this gave satisfactory results.

The meiotic plate showed 30 bivalents (Fig. 1 a, b) with regular anaphase separation.

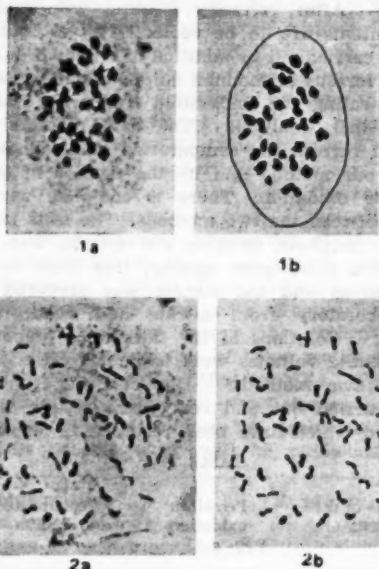


FIG. 1 (a). Late diakinesis in a spore mother cell showing 30 bivalents, $\times 800$.

FIG. 1 (b). Explanatory diagram of the same.

FIG. 2 (a). Metaphase plate in a root tip squash showing 60 chromosomes, $\times 750$.

FIG. 2 (b). Explanatory diagram of the same.

At diplotene, some bivalents which could be clearly studied, showed more than one chiasmata per bivalent but by the time the bivalents reach late diakinesis and early metaphase, each bivalent has one chiasma only. This appears to be the general case in many of the species of this genus so far investigated. The same type of behaviour has been observed in the case of *Botrychium*.² The sporangia showed 16 spore mother cells with normal meiosis in all of them. Sixty-four normal spores were found in each sporangium. At mitotic metaphase, 60 chromosomes (Fig. 2 a, b) were found. The chromosomes in this species were smaller than those in other species like *A. capillus-veneris*,

A. trapeziforme, etc., although the pretreatment and the fixatives used were the same in all the cases. Hence this difference in the size of the chromosomes among different species may be intrinsic.

Manton and Sledge⁴ have reported a triploid ($2n=90$) form of *A. caudatum* from Ceylon which was found to be apogamous. It showed only an 8-celled sporangium. A sexual tetraploid ($n=60$) has been reported from Shai Hills in Gold Coast and also from limestone caves at Pedang Rengas in Malaya. Although the triploid and tetraploid forms have actually been found and studied, the existence of a diploid species in some part of the world has only been inferred (Manton and Sledge⁴). In the present studies, the diploid form having ($n=30$) occurring in nature is being reported. With this exploration of a diploid species, a complete polyploid link can now be established from $n=30$ to $n=60$, the basic chromosome number being 30. This appears to be a case of intraspecific polyploidy restricted up to a tetraploid stage.

The existence of the triploid and tetraploid forms of this species in Ceylon, Malaya, and Gold Coast very well supports the view of Manton and Sledge⁴ that the pace of evolution is faster in the tropics than in temperate latitudes. Then the polyploid forms are also able to colonise much wider areas and exist under a variety of ecological and topographical conditions, as have been shown by Love and Love⁵ and others.

Botany Department,
Patna University,
Patna, July 22, 1957.

R. P. ROY.
BAXI M. B. SINHA.

EMBRYOLOGY OF TWO SIMAROUBACEAE

THE only embryological work in the family since the publication of *Vergleichende Embryologie der Angiospermen* by Schnarf (1931), is by Wieger (1935) who studied 15 species distributed in 11 genera.* The present paper deals with the embryology of *Ailanthus excelsa* Roxb. and *Balanites roxburghii* Planch.

The anther structure shows an epidermis and four wall layers of which the innermost functions as a secretory tapetum (Fig. 1). In the mature anther a fibrous endothecium is developed from the hypodermal wall layer. The tapetal cells are uninucleate in early stages but later become 2-nucleate (Fig. 1). Cytokinesis

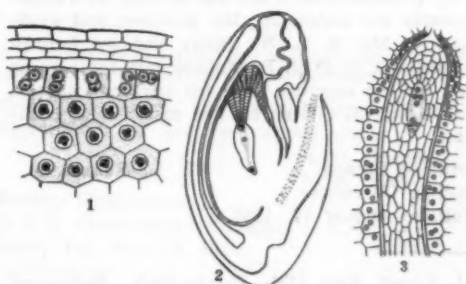


FIG. 1. *Balanites roxburghii*: T.S. anther, $\times 245$.

FIG. 2. *Ailanthus excelsa*: L.S. of ovule, $\times 42.5$.

FIG. 3. *Balanites roxburghii*: L.S. ovule, showing the endothelium, $\times 180.5$.

takes place by furrowing. Pollen tetrads are tetrahedral. Pollen grains are 3-porate and are 2-celled at the shedding stage.

The gynaecium is 5-carpellary, syncarpous in *Balanites*, while in *Ailanthus* it is represented by 5 apocarpous pistils. The ovules are hemianatropous, crassinucellate and bitegmic (Fig. 2). In *Ailanthus* the conducting strand stops at the base of the ovule in early stages and in older stages extends beyond the chalazal (Fig. 2). The integuments are free from one another and from the nucellus (Fig. 2). In *Balanites*, the innermost layer of the inner integument develops into the endothelium, some of whose cells show 2-4 nuclei (Fig. 3). In *Ailanthus*, a space is formed between the outer integument and the inner integument at the base of the ovule (Fig. 2). The inner integument becomes many-layered in the apical region and forms a zigzag micropyle (Fig. 2). In *Balanites* also the situation is closely similar.

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2. Gopal-Ayengar, A. R., *Proc. Ind. Sci. Cong.*, 1957, p. 249.
3. Manton, I., *Problems of Cytology and Evolution in Pteridophyta*, London, Camb. Univ. Press, 1950.
4. — and Sledge, W. A., "Observations on the cytology and taxonomy of pteridophyte flora of Ceylon" *Phil. Trans. Roy. Bot. Soc.*, London, 1954, **236 B**, 127.
5. Love, A. and Love, D., "The Geobotanical significance of polyploidy. I. Polyploidy and latitude." *Portugalia Acta Biologica Series A*, Lisboa, 1949.

The primary archesporium in the ovule is single-celled in *Ailanthus*, but multicellular in *Balanites*. An extensive parietal tissue is formed by repeated periclinal and anticlinal divisions of the primary parietal cell in *Ailanthus* (Fig. 2) but consists of only a few layers of cells in *Balanites* (Fig. 3). A prominent nucellar cap, formed by periclinal divisions of the nucellar epidermis, occurs in *Ailanthus* (Fig. 2). Similar cap formation was reported by Wieger (1935) in the genera studied by him. In *Balanites*, however, no such regular cap formation could be observed, although occasionally the cells of the nucellar epidermis undergo periclinal divisions. The embryo-sac development in both the genera follows the normal type and shows the usual organisation.

My grateful thanks are due to Prof. J. Venkateswarlu for suggesting the problem and guidance, to Mr. R. L. N. Sastry for his helpful suggestions, to Prof. P. Maheshwari for loaning some of the reprints from his personal library, and to Sri. R. S. Rao for the material of *Balanites*.

Dept. of Botany,
Andhra University,
Waltair, August 17, 1957.

L. L. NARAYANA.

1. Schnarf, Karl, 1931, *Vergleichende Embryologie der Angiospermen*, Berlin.
2. Wieger, J., 1935, *Embryological Studies in the Families Buxaceae, Meliaceae, Simarubaceae and Burseraceae*, Diss. Lund.

* While this paper was in press, the author came across a paper on "Floral Morphology and embryology of *Balanites roxburghii* Planch.," by N. C. Nair and R. K. Jain in *Lloydia*, 1956, 19, 269-79. My observations are substantially in agreement with theirs.

**APANTELES BAORIS WILKINSON
(BRACONIDAE: HYMENOPTERA) ON
THE RICE SKIPPER, PARNARA
MATHIAS FABR.**

WHILE investigating the biology of the Rice Skipper, *Parnara mathias* Fabr., the author has collected two species of braconid parasites from full-grown larvae. One of them is still under identification while the other has been identified as *Apanteles baoris* Wilkinson. A perusal of relevant literature reveals that this is the first record of its occurrence in India although Bhatnagar (1948) has listed it in his Parasite-Host index of *Apanteles* spp., probably from Wilkinson's (1930) description of the parasite

collected in Malaya. Wilkinson (*loc. cit.*) described it as a new species from the material obtained on *P. mathias* and *P. bada* on rice in Malaya. According to Chu (1934), *A. baoris* has also been observed on *Parnara guttatus* Brem. from Hangchow in China.

The parasite is gregarious in habit each host larva yielding more than 6-7 adult parasites. During the months of June and July 1955, the percentage of parasitism was found to range from 3.2 to 12.5%.

My sincere thanks are due to Mr. Fazlulla Shareef, Field Assistant, Section of Entomology, Government Agricultural Research Station, Rudrur, Andhra Pradesh, for assistance received. Grateful acknowledgements are also made to the authorities of the Commonwealth Institute of Entomology, London, for identification of the parasite and also furnishing extracts from relevant literature.

Assistant Entomologist,
618, Skipp's Compound,
Malleswaram, Bangalore-3,
July 29, 1957.

D. V. MURTHY.

1. Bhatnagar, S. P., *Ind. Jour. Ent.*, 1948, 10 (2), 133-203.
2. Chu, Joo-tso, (In Chinese), *Ent. and Phytopath.*, 1934, 2 (34), 662-63 (Abstracted in *Review of Applied Entomology*, 23 A, 163).
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**THREE VIRUS DISEASES OF HILL
FRUITS IN KUMAON**

DURING a survey for virus diseases of fruit trees in Ranikhet, Ramgarh, and other areas in Kumaon, several trees of plums, peaches and apples showed virus-like symptoms on some branches. Buds from such diseased plants were worked to healthy stocks of seedlings in October and the presence of virus was confirmed on the new foliage of the budded plants in the following spring. The following three diseases were successfully transmitted by budding and grafting:—

1. Line Pattern Disease in Plums caused by Plum line pattern virus. Syn. Plum Shiro line pattern virus, Peach-line pattern virus.

Symptoms of this disease consist of yellow or creamy white patterns on the leaves emerging in the spring. Usually the veins are pale yellow in colour scattered like network (Fig. 1). This may occur either in a single leaf, one branch or sometimes in the entire branch. As

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FIG. 1



FIG. 2



FIG. 3

FIG. 1. Plum line pattern symptoms on variety Maynard. FIG. 2. Symptoms of oak leaf type on plum variety Ramgarh Maynard. FIG. 3. Mild apple mosaic strain (a) and severe apple mosaic strain (b) on variety Red Astrachan.

the spring passes, the leaves show conspicuous yellow veins throughout the summer which tend to become ill defined in autumn. Later on, a pattern of light coloured lines resembling an oak leaf is visible (Fig. 2).

Varieties found infected are Ramgarh Maynard, Maynard, Plum I, Sharpe's early and Japanese Plum.

2. Apple mosaic in apples caused by the Apple mosaic virus *Syn. Pyrus virus 2*, *Marmor mali* H.

Infected plants show small irregular creamy or yellow spots on the leaves. In most cases bands of chlorotic tissue develop along the veins. Usually few infected leaves are seen among apparently normal ones. It appears that more than one strain is present. In varieties Red Astrachan, Jonathan and Delicious, severe apple mosaic strain of Posnette and Cropley,¹ and in varieties King, King David, Tomkin, Russett and St. Pippin mild apple mosaic strain has been observed (Fig. 3).

3. Necrotic leaf-spot in Peach caused by Peach Necrotic leaf-spot virus.

Symptoms on variety White peach consist of chlorotic spots with a trace of spot necrosis. The affected leaves become distorted and foliation is retarded. Later on brown necrotic areas appear, which fall out leaving small holes in the leaves.

This is the first record of the above diseases in India. Further experiments on their host range, effect of environment and host on symptom expression are in progress.

The writers are grateful to I.C.A.R., New Delhi, for funds and the Superintendent and

Staff, Government Hill Fruit Research Station, Chaubattia, for help in various ways.

K. S. BHARGAVA.
N. S. BIST.

Botany Department,
D. S. B. Government College,
Naini Tal, July 22, 1957.

I. Posnette, A. F. and Cropley, R., *Rep. E. Mall. Res. Stat.*, 1951-52, 128-30.

INSECTICIDAL PROPERTY OF THE FUNGUS, *GANODERMA LUCIDUM* ATTACKING PALMS

WHILE investigating the possibility of utilising petals of common plants against the rice weevil (*Sitophilus oryzae* L.) and other insects^{1,2} the fruit-body of the fungus *Ganoderma lucidum* causing Anabe Roga or root disease of coconut was also casually given a trial, with encouraging results. The details of the trial are as follows:

1.1 g. of the fruit-body of the fungus was ground well with 10 c.c. of white kerosene oil in a laboratory mortar. (This is equivalent to 1 lb. in 1 gallon.) This extract (11%) was further diluted to 5.5%, 2.75% and 1.375% by the addition of kerosene oil. The extracts were kept in tubes to allow the solid matter to settle down. The clear liquid was sprayed with a 'Holm spray' atomizer on a known population of weevils exposed on a filter-paper-lined Petri dish which was held in a vertical position 18" from the tip of the nozzle. The sprayed insects were immediately transferred to a specimen tube with a few Jowar grains inside.

They were examined 24 hours and 48 hours after treatment, the number found dead being recorded at each examination. Kerosene oil-sprayed controls were maintained in each case. The results of treatment are given in Table I.

TABLE I

Percentage strength of extract	No. of tests	No. of weevils	Average P. C. of mortality after		Remarks
			24 hr.	48 hr.	
11	9	172	72	80.8	
5.5	5	80	92.5	..	
2.75	4	80	75	77.5	
1.375	1	20	20	25	
Kerosene oil control	..	26	40.5		
Pyrethrum extract	..	67.6	75.3		Early trials

From these data it is seen that the first three strengths (11% to 2.75%) of *Ganoderma* extract have given high percentages of mortality compared to kerosene oil controls. They stand fair comparison with Pyrethrum extract extensively used as an indoor spray material.

Grateful thanks are due to Dr. M. Putta-rudrah, Government Entomologist, for encouragement.

Dept. of Agriculture, D. SESHAGIRI RAO.
Bangalore, August 9, 1957.

- 1 Seshagiri Rao, D., *Ind. Jour. Ent.*, 1955, 17, pt. 1, 121-24.
- 2 —, *A Note on the Insecticidal Property of Petals of Common Plants* (Submitted for publication).

ANALYTICAL APPLICATIONS OF SOME NEW OXIMES

As a part of our investigations on the chemistry of oximes of acetoacetamides, we have prepared the oximes of α isonitrosoacetoacet-(aryl) amides and investigated certain of their reactions of analytical importance; preliminary results are presented here.

The oximes of the anilide, *o*-toluidide and *o*-chloranilide of α isonitrosoacetoacetic acid were prepared from the anilide, *o*-tolui-

dide and *o*-chloranilide of acetoacetic acid respectively, by isonitrosation with nitrous acid, followed by oximation with hydroxylamine hydrochloride. The products obtained are α isonitroso- β oximino-acetoacetanilide (I), m.p. 192° C.,¹ α isonitroso- β oximino-acetoacet-*o*-toluidide (II) (found: N, 17.49%; $C_{11}H_{13}N_3O_4$ requires N, 17.86%), m.p. 195° C. and α isonitroso- β oximino-acetoacet-*o*-chloranilide (III) (found: N, 16.94%; $C_{10}H_{10}N_3O_4Cl$ requires N, 16.42%), m.p. 144° C.

It is observed that like dimethyl glyoxime, these dioximes give yellowish red precipitates with nickel salts and yellow precipitates with palladium salts; besides, these reagents give reddish brown precipitates with cobalt salts and brown precipitates with copper salts. The precipitation of palladium, copper and nickel chelates of these dioximes has been found to be quantitative. Palladium is completely precipitated at a pH as low as 0.1-0.2 by all the three dioximes; copper and nickel are completely precipitated at and above pH values stated below:

Dioxime	pH for copper	pH for nickel
I anilide	.. 4.3	6.2
II <i>o</i> -toluidide	.. 3.0	5.1
III <i>o</i> -chloranilide	.. 2.1	4.4

The metal chelates formed in these cases are found to have the general composition $M(DH)_2$ where M: Pd, Cu or Ni and DH_2 is a dioxime molecule.

Microanalyses were carried out by Shri S. S. Lele.

Chemistry Dept., J. S. DAVE.
Faculty of Science, A. M. TALATI.²
M.S. University of Baroda,
Baroda, March 20, 1957.

1. Knorr and Reuter, *Ber.*, 1894, 27, 1169.
2. Address: Petlad College, Petlad (Via Anand).

SOVIET ARTIFICIAL EARTH SATELLITE

THE world's first artificial earth satellite was successfully launched in the Soviet Union on October 4, 1957, as a part of the programme of the International Geophysical Year. The satellite is reported to be in the form of a sphere with a diameter of 58 cm. weighing 83.6 kg. It carries two radio transmitters which are continuously emitting signals at 20.005 and 40.002 mega cycles frequency. The satellite was sent up with multi stage rockets and according to preliminary data, the carrier rocket gave

the satellite the required orbital speed of some 8,000 metres per second. It reached a height of about 560 miles and is making one complete revolution in 95 minutes, the angle of its orbit to the equatorial plane being 65°.

The successful launching of the first man-made earth satellite is a great achievement and the data that will be transmitted from the satellite back to the earth is expected to contribute a great deal, to our knowledge of the upper atmosphere.

REVIEWS

Kernmomente von H. Kopfermann. Second Revised Edition. (Akademische Verlagsgesellschaft M.B.H. Frankfurt am Main), 1956. Pp. xvi + 462 with 197 figures. Price DM. 54.

This is a second and completely rewritten edition of Prof. Kopfermann's earlier book. In the 15 years since the appearance of the first edition great advances in the measurement of nuclear magnetic and quadrupole moments have taken place, mainly due to the discovery of nuclear magnetic resonance and paramagnetic resonance phenomena in bulk matter. That many nuclei possessed magnetic moment and quadrupole moment was known from hyperfine structure effects and Paschen-Back effects in atomic and molecular optical spectra. Later, the powerful atomic and molecular beam techniques combined with radiofrequency resonance techniques enabled the moments to be determined with more precision than before. But the discovery of nuclear magnetic resonance and paramagnetic resonance and quadrupole resonance made it possible to determine the nuclear moments and their ratios to still higher degrees of accuracy. The emphasis in the work is in keeping with these modern developments.

The book is divided into four parts dealing with nuclear moments in free atoms, in free molecules, in fluids and solids, and nuclear moments and nuclear models. This division has enabled a neat balance to be achieved between the presentation of historical developments and a physical approach on the one hand and between theory and experiment on the other.

The first part deals with the theoretical foundations of the subject of hyperfine structure of spectral lines using the vector model of the atom. It then passes on to the methods of determination of parameters involving the nuclear moments. Optical Hfs measurements and the calculation of nuclear moments and isotope effects find place. The second part on nuclear moments from studies on free molecules gives a survey of methods and deals with nuclear effects in molecular spectra both in the optical and microwave regions. The third part deals with nuclear resonances and paramagnetic resonance. The fourth part discusses the significance of the actual values of nuclear moments in setting up nuclear models and energy level schemes.

Because of our scant knowledge of nuclear forces these approaches are largely empirical in character. However, when a really good theory of nuclear structure arrives, the nuclear moments and their ratios which have been recently determined are sure to play an important part in checking the finer aspects of the theory.

The book is full of excellent and neat illustrations and a large number of useful tables and a comprehensive bibliography. The more important of these have been collected together at the end. The language is simple and easy to understand for English readers and the notation is familiar.

The book is very well produced and, in spite of its nearly 500 pages, is quite compact and has been neatly bound. Such standards of book production are foreign to works in the English language. The book is strongly recommended to all libraries.

G. SURYAN.

The Defect Solid State. By T. J. Gray, D. P. Detwiler, D. E. Rase, W. G. Lawrence, R. R. West and T. J. Jennings. (Interscience Publishers, Inc., New York), 1957. Price \$11.00.

Research work in solid state physics received a fresh impetus during the war years and continues to be one of the major fields of activity from the experimental as well as theoretical points of view. In recent years, investigations have centred around crystalline solids which exhibit interesting physical and chemical properties attributable to their defect constitution. Recognition of this fact has led to a fresh approach to many physico-chemical problems of scientific and technological importance. The book under review concerns itself with solids having a defect constitution and the contents are presented under twelve headings dealing with the theoretical and practical aspects of such materials.

After a brief introduction to the nature of imperfections that occur in solids in Section I, the general nature of semiconductivity and associated phenomena, viz., photoconductivity and luminescence and some theoretical aspects of semiconductivity are dealt with in Sections II and III. The band approximation method of Bloch, and Fermi-Dirac statistics are introduced

in the latter section and the application of these ideas to semiconductors is indicated.

The basic mechanism of diffusion in solids is considered with special reference to the diffusion processes in alkali halides, silver halides, and a few oxide systems in Section IV. In the same section, after consideration of the various diffusion and flow mechanism involved in sintering, a brief account of the qualitative aspects of reactions in the solid state is given. The kinetics of oxidation in metals and the theories of oxidation processes are developed under the heading 'Corrosion Processes' in Section V.

A concise but an excellent account of the magnetic behaviour of solids is presented in Section VI. The properties of ferrites are discussed with particular reference to the spinel type of structure they possess. The experimental techniques of measuring magnetic susceptibilities and nuclear magnetic resonance absorptions are described in this section. Application of the N.M.R. method to defect structures is briefly indicated. Use of paramagnetic resonance absorption methods in investigating the defect nature of solids is an interesting recent development, but this aspect however has not been dealt with.

The theory of heterogeneous catalysis is of great interest to physical chemists and several explanations have been put forward to elucidate the role of catalyst materials in influencing the rates of chemical reactions. It is recognized that the surface of a catalyst offers sites for reactants to meet and the chemisorption of the latter brings about a decrease in the activation energy. The condition and nature of the surface is therefore very important and the theory presented in Section VII connects the kinetics of absorption and desorption processes with the changes in semiconductivity observable with catalyst materials which exhibit large surface conductivity owing to their defect constitution. The magnetic properties of catalyst materials and their relationship to catalytic activity are discussed. The theoretical picture of catalysis presented in this section is no doubt an interesting correlation, but its general validity has to be taken with reserve since it is based on a property which is not an essential criterion for a material to be a catalyst.

A theoretical treatment of dielectric materials is presented in Section VIII in which the discussion is centred round dielectric losses, and the complex nature of the dielectric constant, arising mainly out of relaxation effects in solids having permanent dipoles. The Debye equations are developed and by applying statistical

reasoning, the expression for relaxation time is derived for the case of a dipole with two equilibrium states, assumed to be present in a defect solid. Ferroelectricity and ferroelectric transitions are discussed with particular reference to Barium Titanate.

Phase equilibria considered in Section IX serve as an introduction to the succeeding Sections X and XI which deal with ceramic materials for high temperatures and intermetallic compounds. A wealth of information and details regarding the preparation and properties of several oxide refractories, carbides, borides and nitrides are given in Section X. Under intermetallic compounds, only compounds that exhibit semiconductivity are dealt with. The principles of zone-refining process which is widely used to obtain materials of high purity are explained. Experimental techniques given in the last Section (XII) deal with instrumentation for differential thermal analysis and microbalance techniques.

Though the book covers a wide range of topics, an adequate account of theory and experiment has been presented to stimulate interest in the subject. The book is written in simple style and is generously illustrated with instructive diagrams. References to original literature are given at the end of each section. The book is bound to interest physicists, physical chemists and metallurgists and would be a valuable addition to any scientific or technical library.

A. JAYARAMAN.

Microphotography. (*Photography at Extreme Resolution.*) By G. W. W. Stevens. (Chapman and Hall), 1957. Pp. xvi + 326. Price 50 sh.

The spirit of the craftsman who meticulously inscribes entire sentences on a tiny grain of rice has, under modern conditions, transmigrated to his scientific prototype, the microphotographer. It is indeed astonishing to read of Goldberg's feat of reduction which amounts to compressing the whole text of the Bible into an area less than four millimetres square!

The reader of the book under review is first enticed into this fascinating subject by the practical instructions given in the third chapter, for taking microphotographs of moderate reduction, with makeshift equipment. After being thus lulled into a sense of security, he is led carefully—if rather slowly—through the hazards of really high-resolution microphotography. Innocent-looking topics such as selecting an objective, focussing and maintaining the

focus, and processing, each require a separate chapter in themselves. This is partly because the problems to be surmounted are not merely enlarged versions of those met with in ordinary photography. There are even interesting instances where wave-optical considerations have to be invoked, though such intrusions of wave-optics are surprisingly few when compared with the prevalent situation in sister sciences such as high-resolution microscopy. *Appropos* this comparison, we must remark that for the lay reader the sub-title of the book, 'Photography at Extreme Resolution', rather dubiously fulfils its avowed purpose of distinguishing the subject clearly from *photomicrography*.

In the two penultimate chapters are discussed two extremely important technical applications of microphotography. The first, which can profoundly influence scientific instrument design (as Sir David Brewster had stated long ago) is the production of *graticules* such as eyepiece scales, thread-profile gauges and the like. (The American terminology *reticle* is, for once, undoubtedly preferable.) The second is document microphotography which to many is synonymous with microphotography, and which threatens to reduce the future libraries of the world to Lilliputian proportions. The author has remarked that each of these two topics could well form the subject-matter of an entire book and he has, therefore, been content to review these fields in general terms. The final chapter discusses the potentialities of microphotography as a research tool.

The most wholesome feature of the book is its practical bias: procedures such as the adapting of a microscope for microphotographic work are bound to be appreciated. Copiously illustrated with plates and diagrams, this book—the only one of its kind at present available—will be welcomed by all interested in the noble art of photography.

S. PANCHARATNAM.

La Diffusion dans les Metaux: Comité de Redaction. By J. D. Fast, H. G. Van Bueren, J. Philibert. (Bibliothèque Technique Philips, Distributors for India: Philips Electrical Co. Private, Ltd., 196, Jamshedji Tata Road, Bombay-1), 1957. Pp. 124. Price 37 sh. 6d.

For many years past, a small group of metallurgists from France, Belgium and Holland, and some specialists from other countries joined together at Eindhoven to discuss the actual problems arising in the physics of metals. The discussions held on the 10th and 11th Septem-

ber 1956, concerned themselves with the subject of diffusion in metals. As the subject is one of importance, it was decided to publish the contributions to the symposium as a collected volume.

The lectures at the Conference could be classified as follows: two of them dealt with the studies of the influence of structural defects (joints between the grains); four dealt with the Kirkendall effect; two on the diffusion of inserted atoms and finally one other on the effect of elastic stresses on diffusion. A full introduction and a theoretical discussion of the problem of correlating the movements of the atoms precedes the individual articles.

The book appears in the French language. It is fully illustrated with diagrams and microphotographs and can, therefore, be readily followed even by those not quite familiar with the language.

The reviewer cordially agrees with the hope expressed in the preface that the publication of this book will contribute to the progress and study of the phenomena of diffusion in metals.

C. V. R.

Journal of the Madras University, Vol. 27 B; January 1957.

This number of the *J. Madras Uni.*, B, has been issued on the occasion of the Madras University celebrating its first centenary. It contains 22 articles contributed by distinguished scientists from all over the world. Some of the authors are alumni of the University who have made significant contributions to science.

The volume opens with an article by Sir C. V. Raman on "The Optical Behaviour of Polycrystalline Solids". In this article, some theoretical considerations are followed by observational results in regard to the intensity as well as polarisation characters of light transmitted through such media. Five X-ray diffraction diagrams of polycrystalline solids have been reproduced and their features correlated with the size of the crystallites that compose the medium.

The articles that follow cover a wide range of topics in Biochemistry, Geology, Chemistry, Botany and Mathematics. A summary of the salient features relating to the growth of chemistry in Indian Universities during the past fifty years has been given by Dr. B. B. Dey and an account of the activities of the International Geophysical Year with special reference to the United States program is contained in an article by Dean Spilhaus. Prof. J. B. S. Haldane outlines, *The Elementary Theory of Population*

Growth confining himself to the problem, "How quickly would a population increase or decrease if mortality and fertility as a function of age remained constant over a period of several generations?" Dr. S. Chandrasekhar, a distinguished alumnus of the Madras University, has written an article containing a general discussion of the problem of turbulence and has indicated how the mathematical theory may be developed.

As a supplement to the Centenary Number, a Resume running into about 130 pages has been given of the research activities of the Departments of Science in the University of Madras since their inception. This is a valuable addition.

The Editor and his colleagues on the Editorial Board have taken great trouble to prepare and present this volume on a memorable occasion which marks the completion of a hundred years of praiseworthy existence of a premier University, now well known all over through its alumni. The volume and its contents are worthy of the occasion.

S. BHAGAVANTAM.

Digital Computers. By R. K. Livesley. (Cambridge University Press), 1957. Pp. viii + 53. Price 8 sh. 6 d.

The following remarks made by the author in his preface will give an idea of the contents and purpose of the book:

"This brief account of digital computers has been written mainly for engineers and others who are faced with tedious calculations, so that they can judge the possibility of using these machines in their own numerical work. It describes in general terms what digital computers can do and how they are made to do it, and also gives an account of some of the calculations for which they have so far been used. The emphasis is on the application of machines to routine computing work rather than to research. Since the book is merely an introduction and is not intended for the specialist, I have made no attempt to discuss the design of computing circuits, nor have I tried to make the reader expert in the operation of any particular machine. I have avoided as far as possible any detailed discussion of mathematical techniques. It is often assumed that a digital computer can only be used effectively by those with very advanced mathematical training, but this is largely because many of the problems so far solved on computers have been mathematically complex. The preparation of a nor-

mal engineering calculation for a digital computer certainly requires care and precise thinking, but it does not usually demand great mathematical skill."

There can be no doubt that this book serves a useful purpose. It is heartily to be recommended.

C. V. R.

Laboratory and Workshop Notes, 1953-55.

Compiled and edited by Ruth Lang for the Institute of Physics. (Edward Arnold, Publishers, Ltd., London), 1957. Pp. xii + 248. Price 30 sh.

Numerous short notes on elegant and simple experimental techniques and devices appear in the *Journal of Scientific Instruments*. The collection of these into a series of volumes easily accessible to the experimenter is a welcome step undertaken by the Institute of Physics. This fourth volume of selected notes incorporates 122 devices, tools and techniques classified into seven sections and includes optical, thermal and electrical devices, devices for liquids and gases, and vacuum and high pressure techniques. The present collection, like the previous three others, promises to be of much practical value to experimental scientists.

D. KRISHNAMURTI.

Ion Exchangers in Organic and Biochemistry.

Edited by Calvin Calmon and T. R. E. Kressman. (Interscience Publishers, Inc., New York, N.Y.), 1957. Pp. xii + 761. Price \$15.00.

Ion exchange has become a tool of great utility in organic and biochemistry and its application in industry is increasing. In the laboratory, it has ceased to be a novel technique and is being increasingly used to isolate and separate materials in small quantities for both preparative and analytical work. The outstanding technique developed by Moore and Stein of the quantitative estimation of individual amino acids in a complex mixture with as little as 5 to 15 mg. of the material, which would have left Emil Fisher almost breathless, is an indication of the enormous possibilities in this field. In the industry, in addition to the well-known use for treating water, it is being used for the recovery of antibiotics from the fermented broth in high yields and with great degree of purity. Instead of remaining a complicated technique for the select few only to handle, it is becoming essential for all chemists

who deal with the isolation of chemical substances or engaged in analytical work, to get well acquainted with the power and possibilities of the application of the ion exchange materials. The subject is expanding so fast, just as all useful ones do, that, as stated by the editors, "it is scarcely possible for one to be an expert even in a single branch of ion exchange". Naturally, 37 authors, each of whom "is an acknowledged authority in his own field" have pooled their knowledge to produce this valuable work under review.

The book is divided into three parts. The first two, consisting of nine chapters and comprising a third of the book, deals with the fundamental principles of ion exchange. Chapter 5 gives a useful list of the ion exchange resins in use, and also the equivalents for the resins in use under different trade names. The third part consists of 27 chapters deals with the various applications of ion exchangers to specific aspects of organic and biochemistry. Practically all aspects where ion exchange plays a part—for example in bones, cells, bacteriology, virology, various analytical methods, medicine, water treatment, etc., have been dealt with in a concise way. Each chapter gives also a list of the references and there are over 2,500 references in this volume, which indicates the coverage of information.

Those interested in ion exchange are of two types. One group is engaged in treating ion exchange as a tool to be sharpened and its application widened. The other group comprise those who with a problem in hand, is in search of a technique available which could be advantageously adopted. This volume would be of great value to both these groups and can be unhesitatingly recommended. There are, no doubt, a number of books available on ion exchange but they do not at all make this volume superfluous.

K. GANAPATHI.

Meprobamate and Other Agents Used in Mental Disturbances. (Ann. N.Y. Acad. Sci., Vol. 67, Art. 10), 1957. Pp. 671-894. Price \$4.00.

This is a collection of papers presented at a Conference on 'Meprobamate and Other Agents Used in Mental Disturbances' held by the Sections of Biology and Psychology of the New York Academy of Sciences in October 1956. This follows closely other publications of like nature, e.g., the one on Reserpine published by the Academy in April 1955.

The booklet is in four parts, the first deals with the chemistry, pharmacology and mode of

action of meprobamate; the other three are on the clinical applications of this new drug. The fine opening paper on 'The History of Tension' by Aldous Huxley deals with the problem of consciousness—changing drugs. He speaks of 'an urge to self-transcendence' and a 'profound distaste for the insulated ego' in all human beings and argues that all cultures have methods of their own to achieve this goal. He likens the use of religious methods, Yoga and the like to the chemical method to achieve the same end. He traces the use of 'contemplative drugs' like opium, peyote and 'active' intoxicants like wine, hashish and 'soma' from the earliest times of human civilisation. Finally he tries to peep into the future and visualises tranquillisers—'consciousness-changers' and 'tension-relievers'—which will do their work even more efficiently and at less risk to the human body. 'Human beings will be able to achieve effortlessly what in the past could only be achieved with difficulty, by means of self-control and spiritual exercises'—Huxley predicts.

The next paper is by Berger on the chemistry and mode of action of tranquillising drugs. He divides all tranquillising drugs into 2 groups—those that affect the autonomic nervous system (autonomic suppressants) and those that do not influence it (central relaxants); meprobamate belongs to the latter group. It does not influence conditioned responses and does not alter normal behaviour. The rest of the papers in this section are on behavioural effects on normal subjects, effects on conditioned fear and emotional behaviour, effects on conditioned responses, etc. In general many of the findings of Berger are confirmed or supplemented.

The papers on the clinical applications of meprobamate deal with the influence of this drug on anxiety, alcoholism, chronic headache, senile psychosis, chronic psychiatric patients, etc. Much benefit is claimed, which in the limited experience of the reviewer, seems to be unduly emphatic, if not exaggerated.

The final section deals with the use of meprobamate as a muscle-relaxant in such diverse conditions as rheumatic disease, cerebral palsy, skeletal muscle spasm of acute low back strain, osteo-arthritis, slipped disc, etc.

All tranquillisers, including meprobamate, being symptomatic only—'tension-relievers'—it is well that Harry Beckman in the introductory remarks pleads for the search for 'etiologic' drugs, those that can normalise the basic changes that take place in mental diseases. The booklet ends with the concluding remarks of Gerard which in effect form a fine and critical review of the papers presented at the Conference.

For the experimental pharmacologist dealing with the 'psychotropic' drugs and for the practising psychiatrist, this booklet is indispensable.

D. L. N. MURTI RAO.

Genetics in Plant Breeding—Brookhaven Symposium in Biology, No. 9. (Biology Department, Brookhaven National Laboratory, Upton, New York), 1956. Pp. ix + 236. Price \$1.25.

This report of Symposium held in May 1956, is a welcome addition to literature on plant breeding. This Symposium was held under the auspices of the Brookhaven National Laboratory and many distinguished geneticists from U.S.A. and a few from abroad participated in it.

The value of this report is in the attempt made to evaluate different approaches in plant improvement and in the critical discussion, which followed addresses on selected topics. The topics selected are diverse and include a consideration of uses of changes in chromosomal complement, quantitative inheritance, use of radiation induced mutations as well as the use of natural variability.

Dr. Edgar Anderson has made two contributions, one of which is on the application of chromosomal techniques to maize improvement. The other is on his speciality Character Association Analysis, which he has applied (in collaboration with Frey-tag) effectively to Mexican species of *Phaseolus*. Both these crops are of potential importance in India. Dr. Stebbins has a paper on Artificial Polyploidy as a Tool in Plant Breeding and he stresses that only limited use has been made of this relatively new tool available to the plant breeder. The topics of natural and artificially induced genetic variability are briefly and critically considered. The value of radiation induced mutations are not overemphasised, even though the U.S. Atomic Energy Commission sponsored this work. There are two papers on Biometry, and one on host-pathogen relationship to interest the specialists.

S. SAMPATH.

"Bhagirath" Anniversary Number, Vol. IV, June 1957, No. 1. (Central Water and Power Commission, New Delhi.)

As mentioned in the message of Sri. G. L. Nanda, former Minister of Irrigation and Power, and now Minister for Labour, it was three years ago *Bhagirath* was started as an official organ to disseminate authentic information on the scope, programme, progress and benefits of river valley projects and to educate

public opinion in favour of this important aspect of our national activity. As all readers can testify, the Journal is very creditably fulfilling its purpose. This Annual Number as in previous years maintains its high standard. The articles are very informative and a few are thought-provoking. The first article by Sri. Kanwar Sain assures us the problem of facing the food situation adequately may not present an impossible proposition. Out of a total of 1,356 million acre feet (M.A.Ft.) of surface waters, it is possible to use 450 M.A.Ft. So far only 76 M.A.Ft. has been used. The second article on planned power development highlights the experience of all engineers that the demand for power grows in proportion to the quantum of power made available. Sir J. C. Ghosh has discussed in another article the problems of increasing technical man-power. The proposal is to establish only three more engineering colleges and 27 new polytechnics in addition to increasing the accommodation available in existing 19 colleges and 46 polytechnics. This may hardly satisfy the demand for technical man-power. Sri. Baleshwar Nath has an interesting article on the role research has played in the design of a few hydraulic structures constructed recently. There are a few other interesting articles and news about progress of multipurpose river valley projects under construction.

There are a number of coloured and ordinary photographs. The general get-up is very attractive.

N. S. GOVINDA RAO.

Books Received

Vitamin A. By Thomas Moore. (Elsevier Publ. Co., Cleaver-Hume Press, London, W. 8), 1957. Pp. xx + 645. Price 76 sh.

Advances in Enzymology, Vol. 18. Edited by F. F. Nord. (Interscience), 1957. Pp. v + 435. Price \$9.00.

Biochemical Society Symposia, No. 14. The Structure of Nucleic Acids and Their Role in Protein Synthesis. (Cambridge Univ. Press, London, N.W. 1), 1957. Pp. 74. Price 13 sh. 6d.

Plant Virus Serology. By R. E. F. Matthews. (Cambridge Univ. Press, London, N.W. 1), 1957. Pp. xii + 128. Price 27 sh. 6d.

Phosphorus and Fluorine—The Chemistry and Toxic Action of Their Organic Compounds. By B. C. Saunders. (Cambridge Univ. Press, London, N.W. 1), 1957. Pp. xv + 230. Price 32 sh. 6d.

SCIENCE NOTES AND NEWS

Electronic Brain Controls Industrial Processes

Electronic brains, which have intelligence, memory, learning ability, and can make decisions for themselves can now be supplied by Solartron Electronic Group, Ltd., for control of almost any industrial process. Such machines, which are the result of the growing up of the now famous "Eucrates" resemble certain features of the human brain, rather than those of a machine or computer; they are capable of taking action on a decision they may reach.

To the industrialist, it is no longer a matter of having to make room for an installation of a ponderous piece of electronic equipment. 'Eucrates' is relatively small, compact and cleanly constructed, varying in size from an ordinary television console to a combined television, radio and radiogram. Its application may be broadly stated as synchronization of machine and operator performance. It can control plants, measure operator efficiency, determine the best solution for efficient programming of production.

Cern Cyclotron

The Director-General of the European Organization for Nuclear Research (CERN), Professor C. J. Bakker has just announced that the synchro-cyclotron which the organization has built is now operating at full strength. It has a peak output of 600 million electron volts and is the third largest of the kind in the world.

A second high energy accelerator, a 25,000 million electron volt proton synchrotron is at present being constructed and should be completed sometime toward the end of 1960. The financial cost of this undertaking is being borne by twelve European countries, but scientists from countries not members of the organization may carry out research at the centre which is at Meyrin, near Geneva.

Pearl Culture in Australia

Both 'half-pearls' and 'graft-pearls' have been cultured. The technique of half-pearl culture is to insert a spherical mother of pearl nucleus beneath the mantle of the oyster, where it becomes coated with nacre and cemented to the shell. To prevent its initial extrusion, it must either be placed behind the adductor muscle or affixed to the nacreous shell border. When the pearl is removed, there will be a flaw at the point of attachment, and this must be covered

in the jewel setting. Hence the name half-pearl. The technique of graft-pearl culture is to insert the nucleus within the tissues, and to place in contact with it a mantle graft from another oyster. The transplanted mantle tissue grows around the nucleus to form a pearl-sac, and in this new position secretes nacre around the nucleus, just as in its original position, it secreted nacre upon the shell surface. The result is a completely spherical pearl.

Of the nuclei inserted for half-pearl culture, 70% were retained. Periodic sampling showed that they became cemented to the shell within a month, and completely covered by nacre in three months. It is estimated that a half-pearl would reach marketable quality in 9-12 months. This represents the first production of cultured pearls in Australia.

Sound Microscope

A sound microscope is at present being developed whereby ultrasonic waves are passed through material and detected by a heat sensitive thermocouple embedded in a small portion of the specimen. The method is thought to be feasible but extensive development work estimated to take several years, is still required.

It is probable that the use of sound may further reveal unknown structures and boundaries, and confirm known structures of materials. The work is being carried out at the Bioacoustics Laboratory, University of Illinois, and is sponsored by the American Cancer Society.

Conference on High Polymers

A Conference on High Polymers is to be held at Nottingham University from 21 to 24 July 1958. Proceedings will be divided into two sections meeting simultaneously. Main subjects for discussion will be:

Section A (Reaction Mechanism and Kinetics): Heterogeneous polymerisation (including trapped or inactive radicals); and production of graft and block copolymers.

Section B (Physical, Thermodynamic and Mechanical Properties): Papers to be related to topics of Section A will be specially welcome, but discussion will not be restricted to those materials.

Abstracts should be sent to the International High Polymer Conference, the University, Manchester-13.

Symposium on Rare Metals

A Symposium on "Rare Metals" is being jointly organized by the Indian Institute of Metals, the Atomic Energy Establishment of the Government of India and UNESCO. The Symposium will be held in Bombay from 1st-5th December 1957. A number of eminent Indian scientists and technologists will participate.

Elasticity and Plasticity

A Scientific Conference, organized by the Polish Academy of Sciences, was held at Krynica, Poland, from August 2 to August 16, 1957. It was attended by 80 delegates from various parts in Poland. Prof. B. R. Seth of the Indian Institute of Technology, Kharagpur, attended the Conference and presided over one of the sections on plasticity.

Forty-five invited papers were presented before the Conference.

The inspiration of the Conference came from Prof. Olszak and Prof. Nowacki who have made a large number of contributions to this subject in recent years.

The main subjects discussed at the Conference were: (i) Theory of Plasticity of (a) Isotropic bodies, (b) Non-homogeneous and Anisotropic bodies; (ii) Thermo-elastic problems; (iii) Mixed boundary value problems.

250th Anniversary of the Technical University in Prague, Czechoslovakia

The Technical University of Prague has just celebrated the 250th anniversary of the foundation of technical schools by an International Scientific Conference, in which 135 foreign scientists took part.

At this Conference, 85 scientific papers were read, 39 of them by foreign scientists and the subjects covered all branches of learning dealt with at the Technical University of Prague, i.e., building construction, architecture and civil engineering, mechanical engineering, electrotechnics, silviculture, geodesy, engineer-

ing economics, etc. The papers will be published in book-form in the language in which they were read.

The Scientific Conference made it possible for both Czechoslovakian and foreign scientists and teachers of the technical schools of university standard to exchange their views and experiences.

Indian Academy of Sciences

The Twenty-Third Annual Meeting of the Indian Academy of Sciences will be held at Tirupati on the 28th, 29th and 30th December 1957, under the auspices of the Sri Venkateswara University. Sir C. V. Raman, F.R.S. N.L., will preside over the Meeting. Sri. M. Sanjiva Reddy, Chief Minister, Andhra Pradesh, is expected to inaugurate the Meeting.

Indian Science Congress

The Forty-Fifth Annual Session of the Indian Science Congress will be held at Madras from January 4 to 10, 1958, under the auspices of the University of Madras. Dr. M. S. Thacker will preside over the Session. Shri Jawaharlal Nehru, Prime Minister of India, is expected to inaugurate the Session.

Award of Research Degrees

Andhra University has awarded the D.Sc. Degree in Physics to Shri J. Satyanarayan Murty for his thesis entitled, "Diffraction of Light by Ultrasonic Waves"; D.Sc. Degree in Technology to Messrs. C. Venkateswarlu, R. Satapathy, and T. Gopichand for their thesis entitled, "Applied Kinetic Studies of Vapour Phase Catalytic Esterification, Hydrolysis and Re-esterification"; "Studies on Condensation of Single and Mixed Vapours with and without Sub-cooling"; and "Studies in Pneumatic Conveying and Continuous Fluidization of Solids in Air" respectively; and the D.Sc. Degree in Geology to Shri J. S. R. Krishna Rao for his thesis entitled, "Genesis of Manganese Ore Deposits of Visakhapatnam and Srikakulam Districts".

NOTICE

THE Offices of the Current Science Association have been permanently shifted to the Raman Research Institute, Bangalore-6.

All material intended for publication in *Current Science* and books for review may therefore be addressed hereafter to:

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Raman Research Institute,
Hebbal P.O., Bangalore-6.

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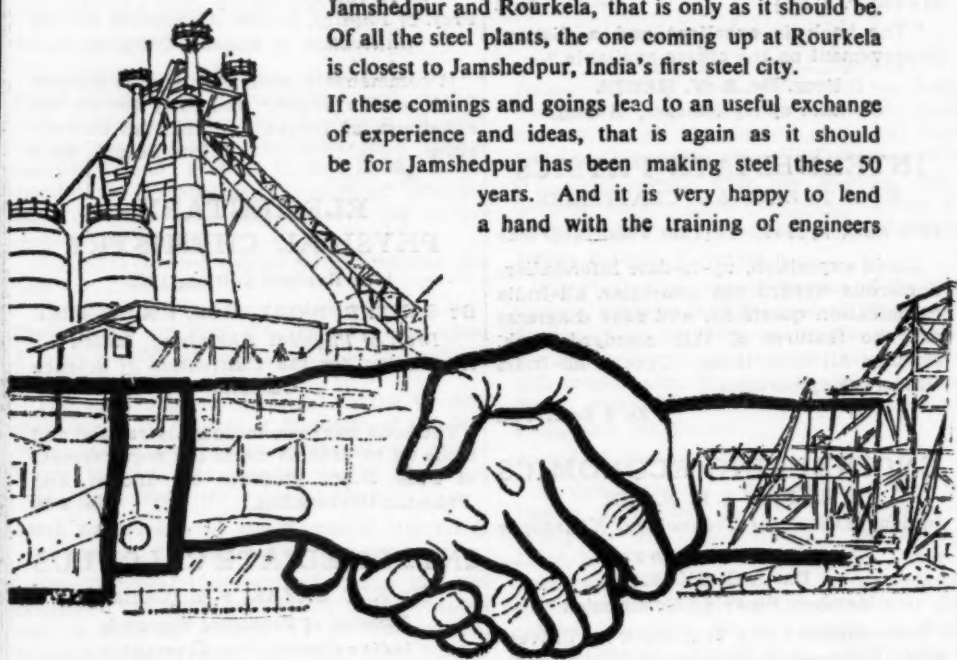
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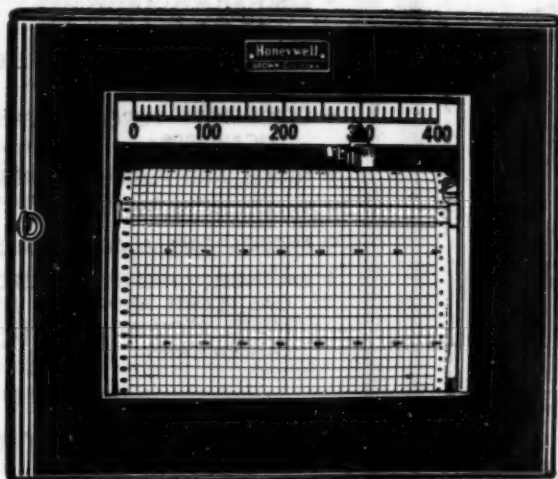
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and technicians for Rourkela. There are nearly 150 of them at Jamshedpur—from key personnel to artisans.

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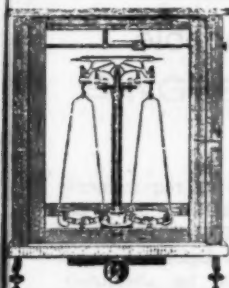
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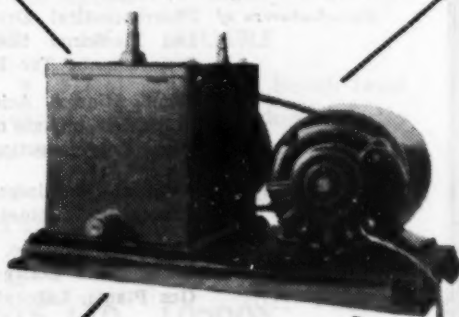
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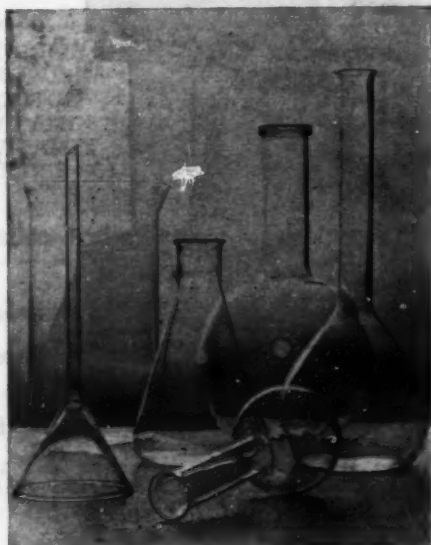
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